AMERICAN MACHINIST

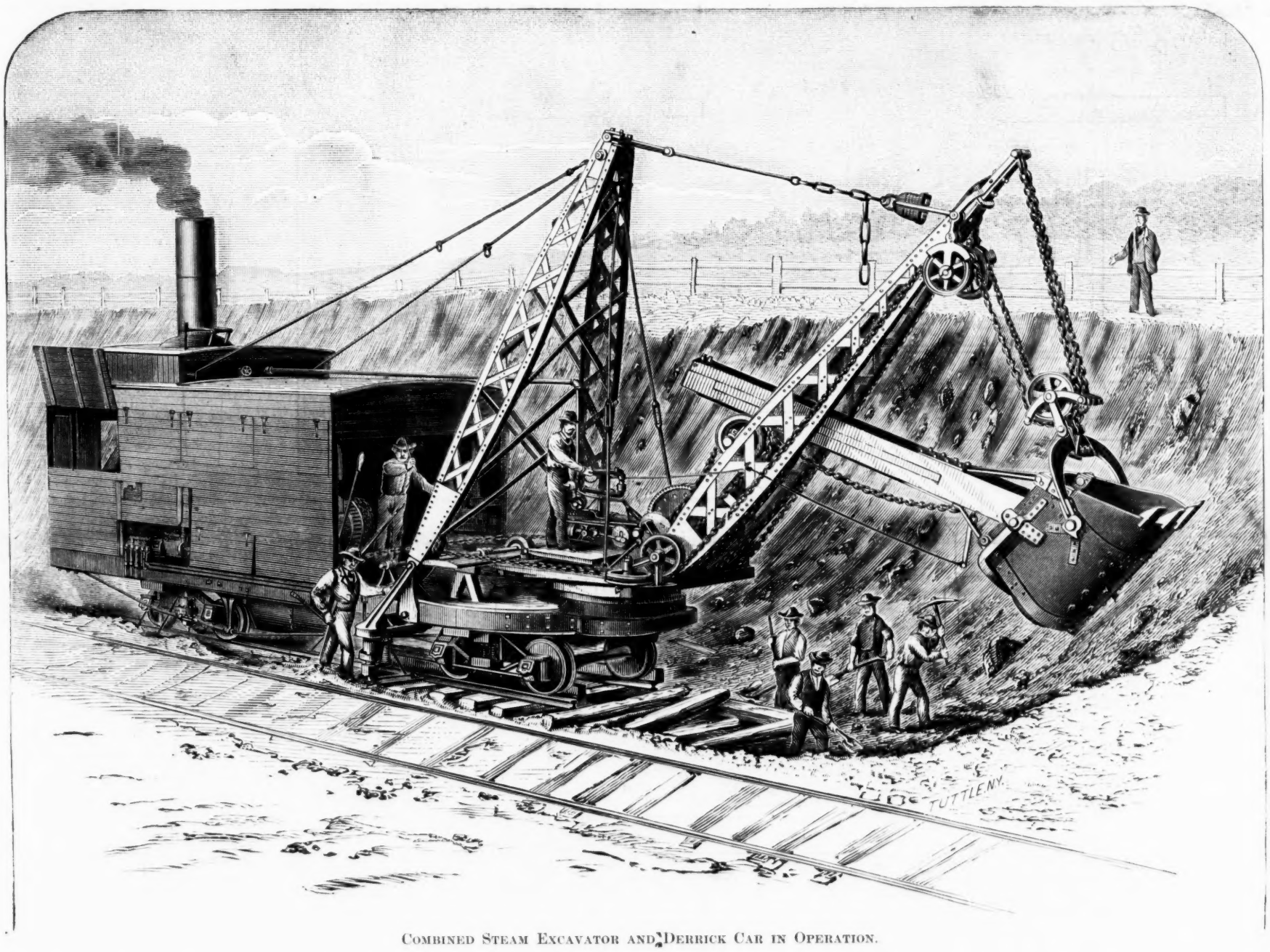
A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 5, No. 33 WEEKLY. | NEW YORK, AUGUST 19, 1882. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

COPYRIGHT. 1882, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.



COMBINED STEAM EXCAVATOR AND DERRICK CAR IN OPERATION.

New Combined Steam Excavator and Derrick Car.

In building railroads, and in other work where large quantities of material must be removed, the land excavator has come to be of scarcely less importance than the under-water excavator or dredging machine in the improvement of rivers, harbors, canals, etc. Particularly in this country where the wages of unskilled labor are comparatively high, the question of the use of machinery of the first named class in place of costly and slow hand labor, becomes an important one in the problem of railway construction, and one that will in the future exert a continually increasing influence on possible progress in this direction.

A successful machine of this kind must be of reasonably simple construction: adapted to work in the variety of material—from the hardest to the softest—encountered in different localities, and particularly must be constructed to withstand the severe shocks and strains to which such machinery is subjected when working; the latter consideration, being outside of absolute calculation, and only successfully met by actual experience.

It must also be so arranged as to do the work for which it is calculated without requiring the services of a large force of skilled operators.

The accompanying engraving represents a combined steam excavator and derrick car, built by Osgood & Macnaughton, 57 State street, Albany, N. Y., for use on the West Shore Railroad, which combines in its construction many important features adapted by the designer, Ralph R. Osgood, who has for 25 years been connected with the operation and construction of both land and under-water excavators.

As will be seen the machinery is mounted on a platform car expressly constructed to receive it, the trucks of which are made to correspond to the gauge of the road, so that it can be handled by a locomotive or placed in an ordinary freight train, and moved on the road where required for use. To adapt it for this the *A* frame is hinged at the lower end, and together with the boom can be lowered down so as to rest on a platform car placed immediately in front of the excavator car, when the whole will pass through any bridge through which an ordinary freight train will pass. The work of preparation, that is, the lowering of the *A* frame and boom, being done by machinery, the time required to get the excavator from its working condition into shape for transportation is only 30 minutes. Having been moved to its destination it can in the same time be made ready for work. This is a matter of considerable importance when the machine is used for different purposes along the line of a road already constructed, and when used by a contractor in construction, time saved in this way frequently implies not only the time of those immediately engaged with the machine, but the time of large gangs of workmen engaged in the general work.

In operating as an excavator, in construction, the machine is moved up to the work on a short temporary track, when the weight, and the strain of the machinery while working, is taken off the trucks by four jacks, so placed as to leave the rails free to be moved forward for another advance, the operation being rapidly repeated as required In the case of this particular machine, hydraulic jacks or lifts are used for raising the machine, the pressure being supplied by a pump working up to 1,000 pounds to the square inch; but powerful screws will serve substantially the same purpose. The material removed is dumped on cars for removal, or otherwise disposed of.

The dipper is of the "Osgood" type, is made of steel, has a capacity of two cubic yards, and weighs 3,000 pounds. It is operated, so far as hoisting and swinging are concerned, by a pair of engines with cylinders $10'' \times 12''$, powerfully geared to drums for two separate hoisting chains, by means of which the swinging is accomplished without the aid of other machinery. The thrusting—that is, the forcing of the dipper against the bank in digging, or away from the boom for dumping—is done by the use of a pair of coupled engines, $6\frac{1}{4}'' \times 10''$, which are placed on the turn-table, and in charge of the dipper tender. These, being reversing engines, give complete control of the dipper, both in holding to the work and in depositing the material.

The boom is hinged at the bottom to the turn-table, and supported from the *A* frame at the top in such a way that the top or outer end can be readily raised or lowered to change the inclination to suit the work being done. In the chain from the *A* frame to the boom a powerful spring is placed, which by its elasticity modifies the destructive jars otherwise transmitted direct from the dipper to the machinery.

When the machine is used as a derrick, the dipper and dipper-handle are removed—which can be done in few minutes. The machine can then without further preparation be used for handling stones, or heavy weights of any kind, or can be taken anywhere on the road and used as a wrecking-car, its great lifting capacity making it valuable for either purpose, while its general utility is increased by the facility with which it can be changed from an excavator to a derrick, or *vice versa*.

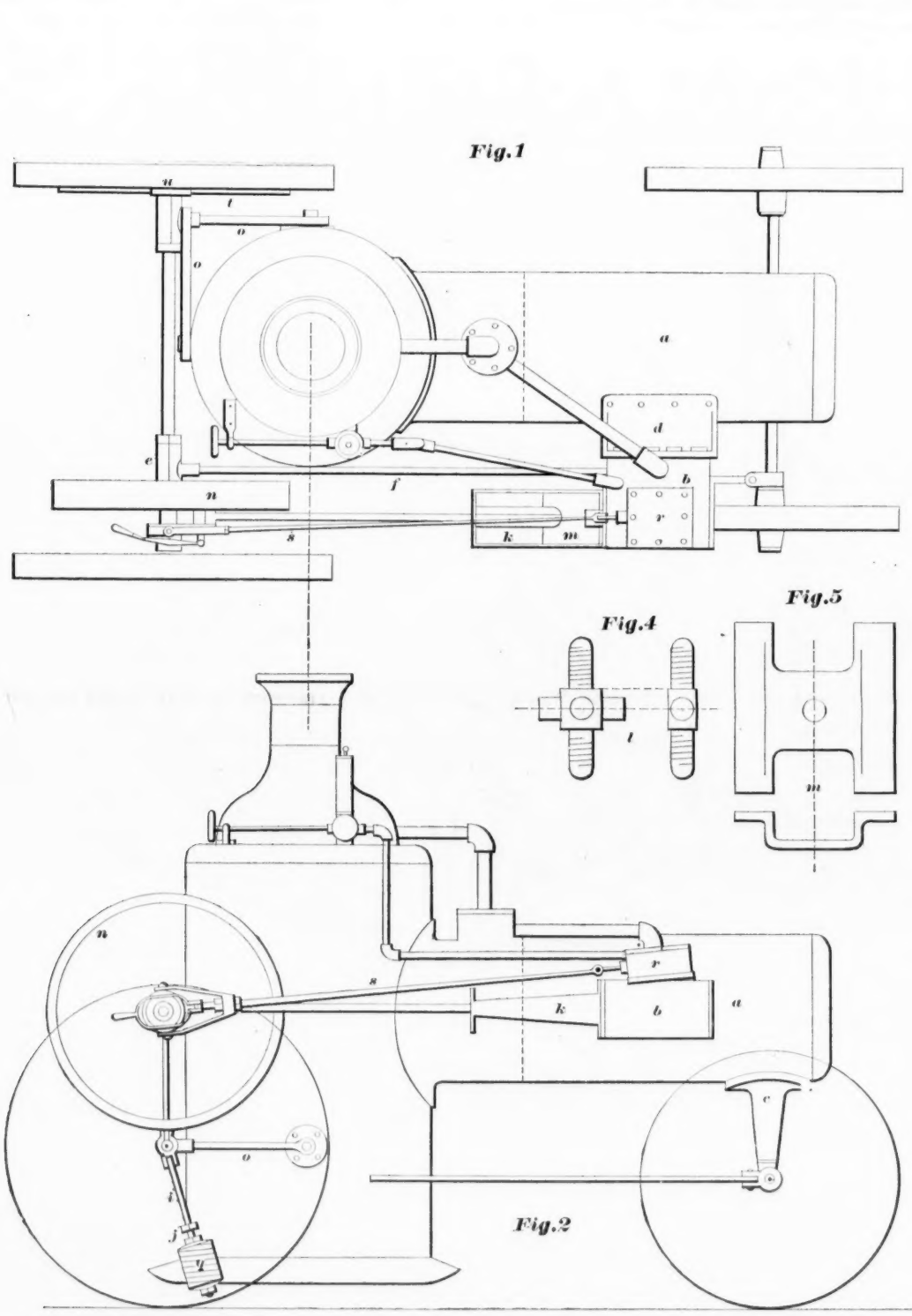
In designing this machine the use of positive clutches—which are always troublesome and are the cause of frequent breakdowns in machinery of this class—has been entirely avoided, approved friction clutches being in all cases substituted.

As previously stated, the capacity of the dipper is two cubic yards, and in ordinary material the capacity of the machinery is two dippers, or four yards, per minute, to accomplish which requires the services of only three men to operate the machinery.

This excavator has been in use about three months, near New Scotland (on the West Shore Railroad), a part of the time on hard pan, so hard that the contractors, for whom the machine was constructed, say that but for its use they must have resorted to blasting; yet of this material, full of small stones and aptly described as *cemented gravel*, from 400 to 600 cubic yards are removed in ten hours.

Notwithstanding the somewhat extraordinary tests to which the machinery has been put, no weakness has been developed in any of the parts, it having, we are informed, exceeded the expectations of all parties. The total weight of the machine, ready for work, is about forty tons.

William Kent has just returned from a trip through England, and has opened an office in Pittsburgh for selling the Babcock & Wilcox boiler.



Portable Engine Refinements.

By F. G. Woodward.

The form of boiler here presented was designed more especially for portable engines of moderate power, say from four to six horse, or from 5 to 7-inch piston, from 4 to 6-inch crank. The boiler is of the ordinary upright, multiflue type, having a water tank, *a*, riveted to its side as shown. The tank being made of ¼-inch boiler plate forms a good support for the cylinder *b*, also for the bolster *c*, for the reception of the king bolt. A small portion of the tank next the boiler (indicated by dot line), is partitioned off for heater through which the exhaust passes to the chimney and through which the feed pipe also passes. The casting *d*, to which the cylinder is bolted is firmly riveted to the tank the seat for the cylinder being previously faced off. The active parts are connected to the boiler by a system of links and pivot boxes, the box *e*, at the crank end being connected to the cylinder by the link *f*, all the other boxes being connected to the boiler by links as clearly shown. The boiler rests upon three springs, two at *q*, and one in the bolster *c*. A strong bar, *h*, Fig. 3, is bolted to the base ring of boiler, an eye being formed in each end of the bar for the reception of the suspenders *i*. When the engine is used stationary the two nuts *j*, may be turned down firmly upon the bar to prevent the action of the springs. The reader will observe that the cylinder head and guides are combined in one casting, *k*. This, with the peculiar construction of cross-head *l*, Fig. 4, and slide *m*, renders these details of extremely easy mechanical construction and adjustment.

The valve gear and reverse motion is a modification of that illustrated in the American Machinist of January 3, 1880. Common coach wheels will answer for three of the trailing wheels; the traction wheel should be of a more substantial make—Figs. 1, 2 and 3, scale, ½ inch a foot. Figs. 4, 5 and 6, scale 1½ inch a foot.

The method of connecting the fly-wheel *n* with the crank has been illustrated in the American Machinist under the head of "Pulley Crank." The connecting rod *p* should be at least twelve times the length of the crank, then by a slight inclination of the valve-chest, *r*, the eccentric rod *s* may be jointed directly to valve stem as shown, at an easy angle. Portables should have small cylinders and a rapid motion, and if designed as self-propellers, the driving gear *t* should grasp the spokes of the traction wheel as closely to its rim as possible, and the pinion *u* should be keyed firmly upon the crank shaft, it may be thrown out of gear by means of the small eccentric shown in Fig. 3.

A Philadelphia paper says that a prominent manufacturing establishment in that city dismisses for the day any workman whose breath smells of liquor. One of the qualifications of a foreman in that establishment is probably a keen sense of smell. But has the supply of "pepper pot" grown small in the saloons of Philadelphia?

A new law regarding boiler explosions has just gone into effect in England. Says the *Ironmonger:*

The law is now extended to boiler explosions on board ship and on railways, and courts of summary jurisdiction have authority in such matters. On the occurrence of an explosion from any boiler to which the Act applies, notice is to be given within 24 hours by the owner to the Board of Trade, or by the user of the boiler, or by the person acting on behalf of the owner or user, to the Board of Trade, and in default the person, on summary conviction, to be liable to a fine not exceeding £20. The Board of Trade is empowered to direct an inquiry as to the explosions by engineers as a preliminary inquiry, and the Board may order a formal investigation to be held in open court, and the usual powers to be vested in such court. Expenses of inquiries are to be provided for by the Board of Trade, and such orders may be enforced, and all extra expenses not authorized are to be paid out of money voted by Parliament The Act is now in force.

Indicator Rig of the Steam Yacht Namouna.

BY LEWIS F. LYNE.

The new steam yacht Namouna, owned by James Gordon Bennett, of New York, is more properly speaking a steam ship, being 223 feet long on deck. The engines are a pair of the compound tandem type having their cranks connected at right angles.

The high pressure cylinders are 22″ in diameter and placed directly over the low pressure cylinders, which are 42′ in diameter with a stroke of 28″.

The propeller has four blades and a pitch of 18′. The boiler pressure is 80 pounds, and the engines make from 82 to 84 revolutions per minute. In the accompanying illustrations, Fig. 1 represents a new permanent indicator rig which I designed and constructed for the steamer Namouna. At *A* is shown the high pressure cylinder with the low pressure at *B*, while *C* is the cast iron frame of the engine, *E* the guides, and *D* one of the wrought iron columns of which there are four.

A separate rig was made for each engine, each one being complete in itself. It consisted of a wrought iron arm *G* bolted to the pin upon the cross-head *F* by a $\frac{7}{8}$″ tap bolt. This arm had a rectangular shaped end for the slide *K*. The arm *G* w as made fast precisely at right angles to the guides, and by the aid of a steel steady pin can be removed and replaced without the necessity of using a square, the hole for the pin being reamed tapering and the body of the bolt filling the hole through the arm. The principal object in making this arm so long was to enable me to use a lever *H* 40″ long. I always desire in indicating engines to use a lever as long as possible, as the errors which are always liable to creep in are much less with a long lever than with a short one. The lever in this case was attached to a thimble *P*, and a steady pin or feather inserted to avoid any possibility of the lever changing its position on the thimble. A cast iron collar *I* was fitted to the column *D* by being bored with a piece of iron $\frac{1}{8}$″ thick between the joints, so that after the collar was finished and this iron removed the collar would grip the column securely.

A grooved segment *J* of composition was bored to fit upon the thimble *P*, Fig. 2, and

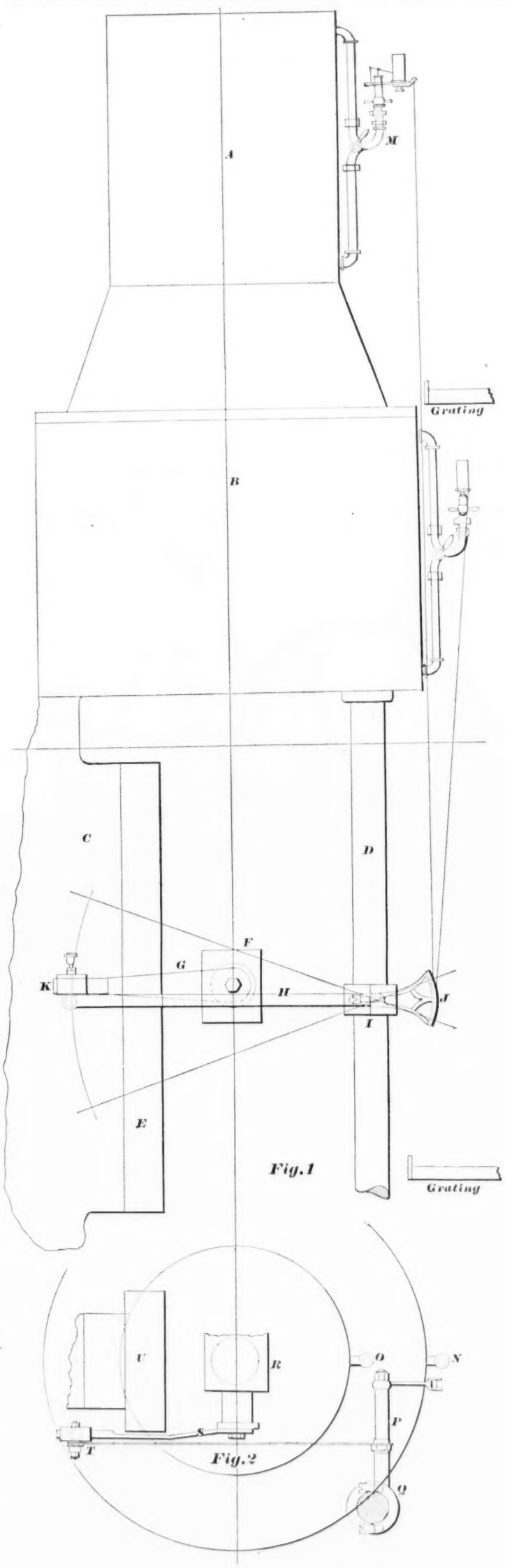


Fig. 1

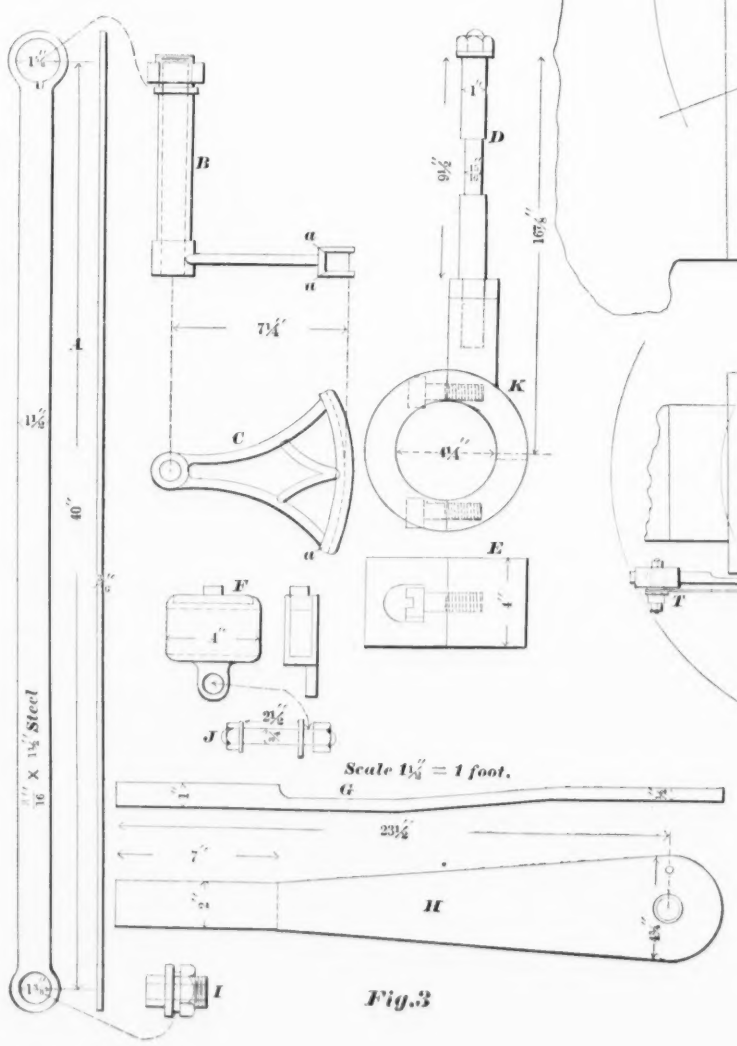


Fig. 3

Fig. 2

was held in place by sweating with soft solder. To set the collar *I*, the cross-head *F* is placed at half stroke, and the lever *H* set precisely at right angles to the guides. The screws in the collar are then tightened, and a steady pin put through the front part, so that when taken down it may be readily replaced.

Fig. 2 shows a plan of this rig, *R* being the cross-head, *U* the guides, *S* the arm attached to the cross-head, *T* the slide, *Q* is the cast-iron collar attached to column, and *P* the thimble with grooved segment. *N O* are the positions of the two indicators *L M*, in Fig. 1.

In Fig. 3 are shown all the different parts drawn to a scale of $1\frac{1}{2}$″ to the foot. *A* is the steel lever, and *B* the composition sleeve, upon the end of which is fitted the grooved segment *C*, as described. The wrought-iron bearing *D* is turned down slightly in the middle to form an oil chamber, and insure perfect lubrication. The bearing *D* is screwed into the cast-iron collar *K*, as shown. The screws for holding this collar together, as shown at *E*, are $\frac{3}{4}$″ in diameter, and are operated by a stout screwdriver applied to the slotted heads. The slide *F* is made of composition, having a gib, as shown, to take up the lost motion as it wears. No set screw is used, as it is considered safer to insert a liner on top of the gib.

The wrought iron pin *J* is attached to the slide *F*, and forms a journal for one end of the lever. The thimble *I* is fitted to the pin *J*, and is made the same as those for the locomotive rig which was published in the AMERICAN MACHINIST of April 1, 1882. *G H* shows the arm to be bolted to the cross-head. The three way cocks for the cylinders were made from the same patterns used for the locomotive rig except an easy turn elbow was fitted to each one looking upward as shown.

The pipes were all of brass, which with the cocks were all neatly finished. It will be noticed that the cords run directly to the indicators, and no guide pulleys are used. The grooved segment has a radius sufficient to give a diagram 5′ long, which is about as long as can be taken and have sufficient clearance for the stops of the paper drum.

The advantages of a permanent rig thus constructed are as follows: It may be run constantly with but little wear, as the wearing surfaces are all large, and it is always ready for use. It is simple and easily made, and diagrams may be taken in a heavy sea with as great accuracy as in smooth water, as there are no guide pulleys attached to the woodwork of the vessel.

Two cords for working the indicators are attached to the grooved segment *J*, Fig. 1, by passing the end of each through a hole at each side of the groove, as shown at *a a a* in Fig. 2, and knotting the ends. These cords do not interfere with each other in the least in practice, as the bottom of the groove is flat, and the cords are sure to keep in the corners, owing to the position of the holes.

The steam pipes to the indicators are $\frac{3}{4}$″ in diameter, and the full pressure of steam within the cylinder is sure to reach the piston of the indicator, which forms the end of the passage.

When this rig was completed and tested upon the trial trip of the Namouna, it met with the approval of the engineer and experts who inspected it, as well as operated to the entire satisfaction of the designer and constructor.

It is hereby published for the free use of any who may wish to adopt such an appliance for marine or upright land engines.

While the Tariff Commission is taking evidence at Long Branch, our Australian exchanges are discussing the evidence of manufacturers of metal goods taken by the Victorian Tariff Commission. One iron bedstead-maker declared he should like a heavier duty, as he would then go into the trade more extensively than he dare now. At the same time he asserted that he could make for £7 as good an article as those imported and sold at £15. Says the *Australasian Trade Review:*

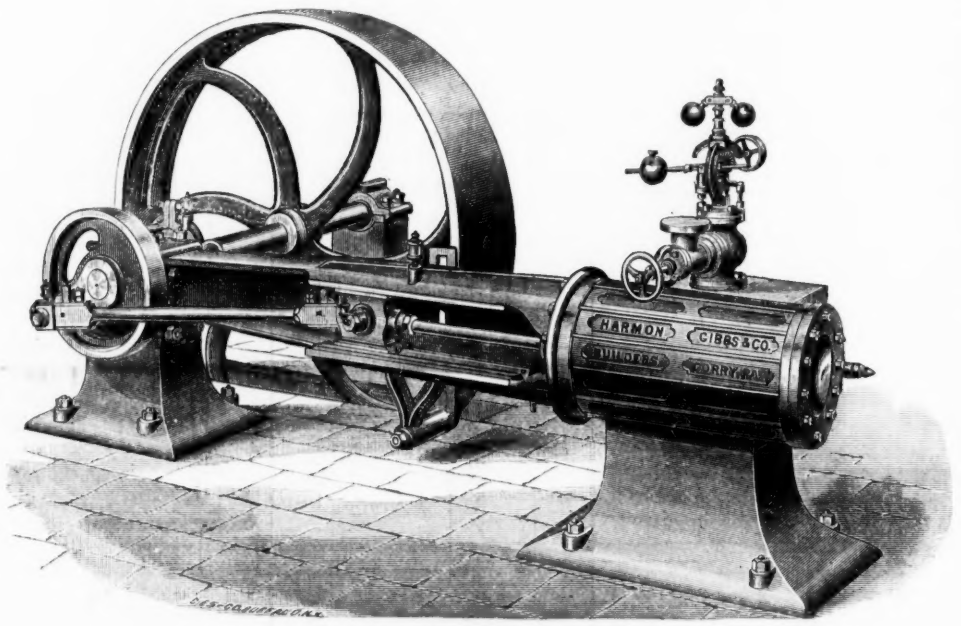
"Of what value is such evidence as this? Or what can be thought of the assertion continually repeated by witnesses, that they cannot get on without duties, and yet that they turn out articles cheaper and better than the imported, whilst all they can claim in the matter is that they fit imported manufactures together?"

When manufacturers go before a tariff commission to testify, they never gain anything by advancing India-rubber truths.

New Steam Engine.

The engraving presented herewith represents a new stationary engine, built by Harmon, Gibbs & Co., of Corry, Penn. The sizes are 16″x24″ and 20″x30″. It was designed especially to meet the demands of their trade for an engine for heavy mill and factory work, and seems to be built with careful attention to strength in every part. The iron in the frame is all placed so as best to resist the strain without vibration. The outer pedestal or pillow block is of the same form, and stands level on the floor with the frame pedestal. The valve is regulated by a variable cut-off attachment by means of a rocker arm. An automatic cut-off attachment is used when desired.

It is claimed that a number of these engines recently placed in Chicago and the West have proved themselves to be especially economical in fuel.



NEW STEAM ENGINE.

Tires of Mixed Metals.

The Saint Chamond Works have recently begun to manufacture tires of mixed metal—half iron and steel—and which, it is claimed, will have the hardness of the latter without its fragility. The body of the tire is composed of a ring made of pieces of puddled steel, and inserted between two hoops of fine iron, which form the outer sides of the section. The whole is welded together by the hammer. The principles of this manufacture are as follows, but they have not been developed very far as yet: A bar of fine iron, which is to serve as the core, is first rolled, and then a hoop of fine iron is put on at each end cold. One of these hoops is afterwards to form the flange, and is composed of three coils of equal size. The other is formed of a single coil, and is to make the outer face of the tire. Wedges of puddled steel are then placed obliquely in the space between the two hoops, thus making so many spirals inclined on the axis of the tire. This arrangement brings the wedges together when the hammer is applied, and thus a complete welding is obtained. The wedges are cut from rolled bars; they should be of hard steel, but yet soft enough to weld easily with fine iron. The round pieces thus obtained are forged and welded with the hammer. Four heats are requisite to obtain a ring like those used in the ordinary processes. The welding is completed by the rolling, and it brings the inside core to such a small thickness that it disappears altogether in the boring.—*Engineering.*

An English invention has for its object the construction of an indicator for gas meters that may be readily read—probably the invention of a gas consumer.

That faith is not an element peculiar to any calling may be seen in the fact that two companies are vigorously traversing New York City with pipes for steam heating, with the thermometer at 99°.

Steam Boiler Afflictions.

Many of the disorders that afflict the human system are peculiar to hot weather. Not so with steam boilers The constitutional and local disorders of boilers are of the same general nature whether the mercury fluctuates about the freezing point or somewhere in the nineties. The Hartford Boiler Insurance Co. has just published the summary of work done by their inspectors during the month of May. It shows that 2,612 visits of inspection were made, during which 5,419 boilers were examined. The number of complete internal inspections foots up 1,874, and 487 others were subjected to hydrostatic pressure. The number of boilers considered worn out and unfit for further use was 39.

The total number of defects found was 2,859, of which number 637 were considered to be of so serious a character as to impair the safety of the boilers in which they were located. The following detailed statement of defects shows their precise nature.

Nature of defects.	Whole number.	Dangerous.
Cases of deposition of sediment	285	62
Cases of incrustation and scale	428	56
Cases of internal grooving	36	19
Cases of internal corrosion	98	21
Cases of external corrosion	129	46
Broken and loose braces and stays	54	20
Settings defective	97	23
Furnaces out of shape	91	19
Fractured plates	174	108
Burned plates	92	17
Blistered plates	225	41
Cases of defective riveting	269	4
Defective heads	16	8
Leaky tubes	402	84
Leaky seams	141	18
Water-gauges defective	56	11
Blow-out defective	27	15
Cases of deficiency of water	6	4
Safety-valves overloaded	35	17
Safety-valves defective in construction	19	11
Pressure gauges defective	174	30
Boilers without pressure gauges	5	2
One dangerous defect unclassified		1
Total	2,859	637

It will be seen from the above that more boilers are troubled with incrustation and scale than any other disorder. It is easy to see why this is so. A very considerable number of boiler owners assume that any time or money devoted to a prevention of scale and sediment is wasted. Therefore they let their boilers become heavily incrusted, thus preventing a good part of the heat from penetrating to the water. The results are a coal bill much larger than there is any need of contracting, and frequently burned plates and leaky tubes Both danger and large extra expense are incurred by neglecting to apply suitable means for keeping boilers clean.

Prices of locomotives have fallen somewhat. The fact is they were higher last year than necessary to afford a good profit, but as the manufacturers had all that they wanted to do and the railways must have the engines at any price, it is not strange that as high as $13,500 was asked and paid for an eight-wheel passenger engine. The locomotive builders made money enough last year to enable them to stand a little lower prices, although they are in no danger of suffering this year. The railways will have a heavy business, the country is prosperous, and the manufacturers are as much entitled to share in the general prosperity as are the farmers, many of whom will grow rich with a single year's harvest.—*The Railway Age.*

A prosperous year for the farmers means a good year for all kinds of legitimate business. The proportion of farmers, however, who grow rich with a single year's harvest is just about equal to the proportion of manufacturers who grow rich with a single year's business. When we see our neighbor doing well by following an occupation we know nothing about, we are more apt to over-estimate than under-estimate his profits.

A Monument for a Great Engineer.

The circular which we print below we have just received from the secretary of the American Institute of Mining Engineers. It will explain a movement which we hope will soon be successful beyond peradventure.

It ought not to take many months to secure subscriptions amounting to $10,000 for a monument to one of the greatest and most universally esteemed engineers America has ever produced.

The manufacturers of American Bessemer steel, who are largely indebted to A. L. Holley for the great success they have achieved, may be expected to honor his memory with some liberal contributions to the monument fund. It is desirable that a good proportion of his numerous friends, both in our own country and in Europe, should be represented as contributors. The circular is as follows:

DEAR SIR:—After the death of Mr. Alexander Lyman Holley, the American Society of Civil Engineers, the American Institute of Mining Engineers, and the American Society of Mechanical Engineers, in each of which he was a leading member, appointed special committees to devise and execute suitable measures in honor of his memory. These committees have united for common action as a joint committee, and this joint committee has appointed the undersigned a sub-committee, with authority to issue the present circular.

Both the character and career of Mr. Holley marked him as a true representative of the highest type of American engineers. Without undervaluing the great advantages of foreign travel and culture, we deem it a significant circumstance that our departed colleague was educated in American schools, and bred in American practice. When he began the journeys abroad from which so many important results were to flow, it was with a thorough knowledge of the condition and needs, in his native land, of the arts with which he was connected; and the astonishingly numerous and varied lines of inquiry which he pursued had one element in common—the dominant purpose of his life—to gather for the benefit of this country the best fruits of skill and experience abroad. Our railway practice, our ordnance system, our steel manufacture, and many incidental points in our mechanical engineering, were successively illuminated by his skillful analysis and criticism, and enriched with the treasures he had wisely selected from foreign sources, as well as the fruits of his own inventive genius.

As an active and enthusiastic laborer for the elevation of the profession through the harmonious co-operation of its members in this country, and as an inspiring instructor and sympathetic friend of young American engineers, his influence was scarcely less important. The unanimity and extent of the expression of sorrow at his death might be called national, had they not been augmented by so many voices from beyond the sea.

Finally, his personal virtues and attractions were such that his countrymen may well delight to honor him. No atom of envy or detraction alloys the praise which all are eager to bestow upon him. Alike in private and in public life, he was beloved as much as he was admired.

It was natural that from many quarters the suggestion should come of a memorial more permanent than words to a life so worthy in itself and so fruitful of blessing to a nation. In obedience to this suggestion, and after due consultation, the following plan has been adopted:

It is proposed to erect in the Central Park of this city a monument to Alexander Lyman Holly, consisting of a suitable pedestal in stone, with architectural and symbolic decoration, surmounted by a portrait bust in bronze. The cost of the whole, executed by the best obtainable skill, and after designs to be approved by the joint committee, will be about ten thousand dollars. Before further steps are taken, it is desirable to ascertain by actual subscriptions the amount of money which may be relied upon; and for this purpose the present circular is issued.

In order that the opportunity of taking part in this testimonial may be extended to as great a number as possible, subscriptions will be received from all who desire to contribute. No limit has been fixed, as it is desired that each subscriber give according to his ability, and that the list be large. Names and money may be sent to Charles Macdonald, treasurer, 52 Wall Street, New York City, and will be periodically acknowledged in the *Iron Age*, the *Engineering and Mining Journal* and the AMERICAN MACHINIST. The subscription is not confined to any class or profession, but is cordially opened to all who sympathize with its object.

CHAS. MACDONALD,
R. W. RAYMOND,
J. C. BAYLES,
} *Sub-Committee.*

The amount of new projects in the way of building operations, which is now developing not only in Chicago, but throughout the entire West (says the *Northwestern Lumberman*), has never been excelled at any period in the history of the country. Newspaper exchanges from every quarter contain notices of improvements contemplated, and contracts entered into for business houses and residences, to an extent which bids fair to give employment to all the skilled artizans in the land. From New York and Boston, as well as other cities of the East, to the Rocky Mountains, every town and hamlet gives word of a demand for an unprecedented quantity of building materials of all classes and descriptions.

In Paris the project of rapid transit by means of elevated railroads seems to have been abandoned in favor of an underground line. According to present plans the total cost of construction will be about $30,000,000. The fare will be ten cents for first-class and four cents for second-class passage, but tickets will be issued to workmen at two cents.

William Kent, of Pittsburgh, Pa., who is now traveling in Europe, has written a letter to the *Northwestern Miller*, in which he refers as follows to machine riveting in one of the shipyards on the Clyde:

One of the many things specially noticeable at Elder & Co.'s shipyard is the extensive use of hydraulic power riveting machines, instead of hand riveting. There are two kinds of riveting machines used, those of Ralph H. Tweddell, C. E., London, and those of Wm. Arrol & Co., of Glasgow. These two machines are now said to be doing nine-tenths of all the riveting on the structural parts of vessels (except the riveting of the ship plates in place; for this purpose machine riveting has thus far not proved economical). It is now universally conceded that machine riveting is superior to hand riveting in filling the holes better, producing a cleaner and smoother clench, and in avoiding the strains in the rivets produced by hammering to a black heat, as is frequently done in hand work. The water pressure used in these riveting machines is about 1,500 pounds per square inch, and it is conveyed in flexible copper tubes of only about one-half inch external diameter. The rapidity of operation in these machines is surprising. One of Tweddell's machines has been known to close, in beams, 1,800 to 1,900 rivets per day of 9½ hours.

Marathon County, Wis., has voted $15,000 in aid to the Neillsville & Northeastern Railroad Co. The aid is payable in county lands at 50c. per acre. The road is to be built and in operation by December 1, 1883, and the construction is to be commenced early next season.

Mechanics and practical men are not the only ones that sometimes preach better than they practice. A Berlin correspondent of the *San Francisco Chronicle* relates an incident of attending, in Germany, a lecture by a distinguished Professor on the subject of the circulation of air through the lungs and its purification there, who talked learnedly of the necessity of pure air, and all the while the densely packed room in which he lectured was closed as tightly as was possible with double windows and a jealously guarded door.

At the beginning of the year, in noticing the scarcity of the water supply, as well as the poor quality in many towns and cities last fall, we hazarded the opinion that what happened at that time would repeat itself, so little likely were communities to learn wisdom by experience. Curiously enough, in the two particular instances then cited, one of which was the city of New York and the other a large town up the Hudson, exactly the same complaints are made this year as last, the only difference being that this year they are made much earlier in the season. In the case of New York the complaints are from consumers, of an insufficient supply, which is met by the statement that under existing conditions the absolute limit is reached every day.

In the other instance referred to, the complaint was as to the quality of the water, and the same complaint — intensified — is made this year, and is met in the same way as last year—that is, by the advice to refrain from using water.

Money is lavishly expended—squandered—in a hundred ways; but when it comes to supplying one of the first necessities of life, the criminal foolishness displayed in many localities will soon pass into a proverb.

Charles Hunt, at the recent meeting of the Gas Institute in London, presented a paper in which he detailed the result of experiments which went to prove that the commonly accepted theory that gas of an inferior quality answered the requirements of a gas engine substantially as well as gas of high illuminating power, is wrong. While an increase of 120 per cent. in the illuminating power of gas only adds 50 per cent. to its heating power, its value for motive power was found by Mr. Hunt's experiments to increase much more rapidly. With gas of 12 candle power 40.08 cubic feet per horse power per hour were required, with gas of 29.14 candle power, only 20.34 cubic feet were used.

The conclusions reached by investigations for the French Government in relation to the use of wire cables in mines is that they should not be used in very moist pits, but that in most other cases wire cables are the best. The diameters of winding drums should be from 80 to 100 times the diameter of the cable. Thick metallic cables should not be worked beyond one-tenth of the force required to break them, and small round cables not beyond one-sixth. Once a week the cable should be run slowly up and down for examination.

In London a company has been formed for the purpose of supplying hydraulic power for the operating of various kinds of machinery.

The completion of the Connotton Valley Railroad to Navarre, Ohio, a week or two ago, was just in time to save the title of the company to a subscription fund by the citizens of that place amounting to $5,000.

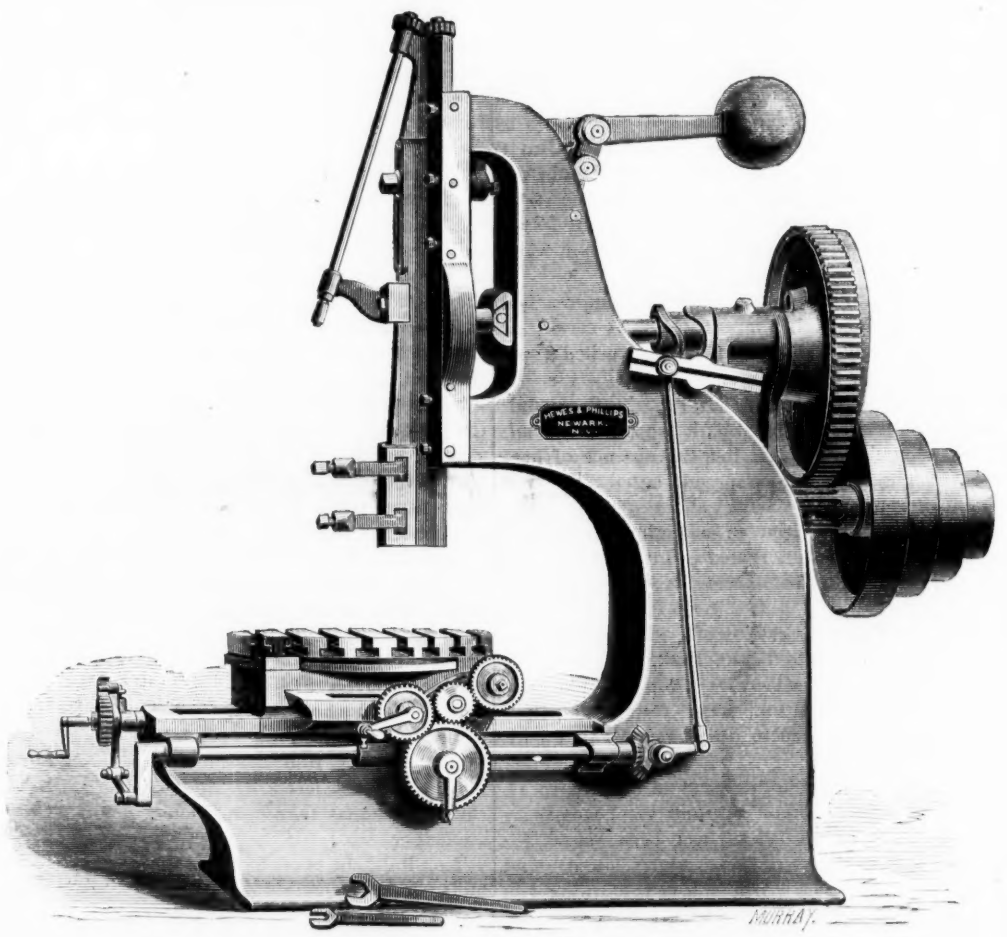
J. E. McConnell, Iowa City, Ia., one of the correspondents of the American Machinist, has taken the position of foreman of the Capital City Iron Works, Des Moines, Ia.

Improved Slotting Machine.

A few years ago a slotting machine might with propriety have been defined as a machine for cutting key-ways in wheels, this being about the only useful purpose it would serve. For this, however, with all its clumsiness, it was a great improvement on previous methods, and where considerable work of the kind was done it was found to be an economical tool. Along with other machine tools, the slotting machine has been so far improved within the past few years as to retain but few of its primitive characteristics except its name, which is not suggestive of its present uses, until from being a tool occasionally found in the large machine shop, its use has come to be almost indispensable.

The accompanying engraving represents one of several sizes of slotting machines built by the Hewes & Phillips Iron Works, Newark, N. J., being their new 12-inch machine.

This machine has a compound table with a longitudinal feed of 24″, and a transverse feed of 28″, with an upper circular table 32″ in diameter, adapted to be automatically revolved by a worm and worm-wheel motion, or to be rigidly clamped to the lower table when the circular feed is not in use. The feed motions of these tables are positive and automatic in all directions, always feeding when the cutting tool is at the upper end of the stroke, and are readily changed from fine to coarse, or anywhere intermediate.



Improved Slotting Machine

The ram has eight speeds, with counterbalance and quick return motion, and the stroke is capable of any variation from zero to full stroke. For changing the relative position of the ram and guides, an angular rod and screw attachment is provided.

The distance from the tool seat on the front side of ram to the inside of the frame is 27″, so that when employed for slotting wheels one of 56″ diameter may be operated upon. The height of the frame above the table is 20″.

All screws and spindles are made of steel, and the wearing surfaces scraped to templets. The lost motion between sliding surfaces is taken up by gibs with screw attachments.

The weight of the machine complete, with countershaft, wrenches, &c., is 9,000 lbs.

The Texas & Pacific Railroad will establish experimental farms along its line next season. The purpose of these farms will be to test the availability of different lands for farming purposes.

LETTERS FROM PRACTICAL MEN.

Raw Spots in Steam Boilers.

Editor American Machinist:

It must be refreshing to many of our practical readers, as it is to me, to get verbatim reports of discussions of practical matters Some of the terms used, it is true, may not be found in technical lexicons, with the definitions appended that are implied by the context of the reports, nor yet would the "Unabridged" be of much use unless the reader is familiar with the subject in a practical way.

In the American Machinist of July 15, and in the number next following, appeared an admirable stenographic report of the discussion that followed the reading of Mr. Wells' report to the American Master Mechanics' Association on locomotive boiler construction. Reading that report brought to mind some facts in my personal experience with grooved boiler plates. When in the cylindrical part of a boiler, this defect is most often found close to the inner lap end of the longitudinal seams, and is there supposed to be caused by the combined mechanical action, which being translated means simply *bending*, and the chemical action of the water, which being interpreted means *rusting*. Thus explained, it should be found where these two actions are found, and there only. The cylindrical shell when made with lapped seams is necessarily distorted to the extent of the thickness of the plate, as every draughtsman well knows who has attempted to draw from a single center a section including a lap.

Bending the plate sharply at the inner edge of the lap causes a *raw spot*, as it was quaintly but appropriately called by the able president of the Association, which extends along the whole length of the longitudinal seam, always in my experience *rawest* at the middle of its length where the bending is greatest, as indicated by the greater depth of the groove at this spot.

The bending of the plate caused by an internal fluid pressure in a hollow cylinder made of lapped plates is in a reverse direction to that which would be caused by an expanding solid; for example: a cast-iron cylinder having cavities for rivet heads, and filling the boiler shell like a mandrel and then to be expanded by an excess of heat. This, it will be seen, would cause wrinkles along the inner edge of the lap by the outward thrust of the solid upon the edge of the plate. But now suppose the hypothetical cast-iron cylinder is cut away also by a furrow just sufficient, or that it is at this place sufficiently yielding to allow the edge of the plate to take a direction which would result from a tensional strain acting parallel to the curve, it would tend to throw the transverse line of the lap into an inclined relation to the true circle, and, if prolonged, it would form a chord. Thus the summit of the bend would move inward as the strain is increased till a true circle applied to the cross section of the laps would cut off a sharp wedge, the "butt" of which would be as thick as the plate, and its length would be equal to the lap of the plates. The *raw spot* is now inside where the solid body would have made wrinkles. Now the skin is either broken or so much stretched as to expose interior bright structure of the metal to the action of the water. The minute interstices are promptly filled with iron rust, which is crushed out by the reverse action due to the stiffness of the plates when the pressure is removed or lessened. This motion, as often as it is repeated, exposes fresh interior minute surfaces and the plate is worn away, at first over a broader bend, and slowly, but afterwards continually, narrowing and deepening the groove. As the weakness increases, the bend caused by the same or no greater force is sharper and the waste is more concentrated.

It is obvious that this defect if neglected becomes dangerous with increasing rapidity, and to it may be charged probably a larger percentage of explosions of cylindrical shells made of good materials than to any other defect, caused by deterioaration or waste of substance. It may be said that good material is quite as likely to suffer from grooving as bad—perhaps more so. On the other hand, it is true that brittle material may crack instead of becoming *raw*, and the narrow deep fissures are more difficult of detection, sometimes quite covered by the lap and between the rivet-holes, or at best usually hidden from the inspector's view by dirt or scale that lodges in the corners. The testimony of some of the members of the Association, which showed that grooving occurs at the cross-seams, supposed to mean of the cylindrical part, and that it does not take place above the water-line in boilers where there is grooving below it, implies a doubt as to the soundness of the doctrine that motion is the foundation of the difficulty. But the fact that covering plates, called *liners* by Mr. Hayes, applied to the inside of both cross and longitudinal lapped seams is a preventive of grooving and also stop it when once started, if such is the fact, may be set down as an important discovery in the art of boiler making, for it has everything in its favor as a method of making seams in shell-boilers intended for high pressure. It restores as nearly as may be the strength of the plate, is cheaper and better than double riveting; riding as it does over the tops of the rivet heads it forms a truss and effectually prevents motion near the lap. As it is merely a system of bracing the lap, the rivets need not be spaced as closely as 5 inches, as in the samples cited in the discussion by Mr. Hayes. If this *liner* really and perfectly prevents grooving, it not only tends to prove, to my mind, the old doctrine that motion is the primary cause of grooving, but upon the testimony of the members who found grooving at the cross-seams, which was also promptly stopped by its use, it also points to the possibility of motion either bending or vibratory at the cross-seams of locomotive boilers, which are tensionally loaded only half as heavily by the same internal pressure as the longitudinal seams are, per unit of lineal measurement. That grooving does not occur above the water line where motion probably is liable to take place, and probably does under conditions that will cause it be-

low the line, indicates that the inner surfaces of the steam room are dry, or free from liquid moisture, at least. This may be shown experimentally with glass boilers used at much lower pressure than that used in locomotive boilers.

Perhaps grooving of cross seams of locomotive boilers below the center (see Mr. Sedgley in AMERICAN MACHINIST, July 22, page 6), may be started by the greater tensional strain in a longitudinal direction on the lower half of the cylinder due to the weight of the water, together with the vibrations or fluttering of the shell and tubes. These motions can hardly be suspected of being cumulative, but they may be of considerable importance when running on a rough road.

It would be interesting to me to pursue the subject of *raw spots*, and their probable causes in other parts of steam boilers, but my letter is already too long for so short a text. S. N. HARTWELL.

Babbitting.

Editor American Machinist:

To prevent a babbitt nut from sticking fast to the screw when poured, a clay wash suits me the best of anything that I have ever tried. I make the wash a little thicker than common white-lead paint, have it free from lumps, and make the screw warm enough to dry it, as I apply it with the bench brush. The thread may not be quite as smooth as it would be without the wash, but this plan at least presents a choice of evils.

With whole journal boxes, by having the arbor greasy—not a heavy coating of oil, but a little greasy—and by observing which, if any, is the smaller end of the arbor, I seldom have any trouble with sticking, if the arbor is smooth.

The metal, in pouring, will lie still on the arbor and make a more uniform surface, if the arbor is not polished, but left with the tool marks in it just as it was turned. This will do in half boxes, but it would be harder to drive out of whole boxes.

Babbitting is not the most agreeable of jobs. The very name of the job is awkward to the tongue, harsh to the ear, and does not look well when written. The daubing of clay, the litter of liners, and the spatterings of the metal do not present a neat and tidy appearance, and hot spatterings sometimes make the operator appear more lively than dignified; and then, too, anybody can melt the metal and pour it into a hole. The farmer's boy, or green mill hand can put a shaft into a shell and pour metal around it, and the machine *may* run all right again, and it may not.

There is room for the display of skill, and there are interesting philosophical points about all the work that I ever met with in a machine shop.

When Old Man Morton found that a man was "kicking" because his job was too common, he had a way of asking questions about the work which generally led to the workman's getting some new ideas into his head about that very job.

The "blowing" of the metal while pouring is one of the things that should be thought of beforehand. Steam, formed from moisture and heated and expanded air, must have a free vent, or they will take a forcible one. Vent holes should not only be large enough, but they should be in the right place, which generally is at the highest point of the cavity. Large pouring holes and large vent holes act as risers and lessen the effect of shrinkage.

I think that it pays to pound the clay well and make a good even, heavy putty of it, then flatten it down as the housewife does dough for biscuit. Then it can be cut into handy strips that will fit into angular places much better than if rolled between the hands.

Fitting the clay well into the crevices is important, for melted metal will search out all such sins of omission.

With two boxes rigidly connected in line, as in the case of saw-arbor boxes, the usual way of pouring at the sides does not give the best results.

The inner ends of both boxes will be low, sometimes nearly $\frac{1}{32}$ of an inch, leaving bearings only at the outer ends of the boxes. This is caused by the metal heating the shaft on the under side only, and the expansion throwing the ends of the shaft upwards while the metal is yet soft. By forming a runner of clay on top of the shaft nearly the whole length of the box, and pouring on top, letting the metal run down over the sides, much better results will be obtained.

Defiance, Ohio. ANTHON.

Weighting Down Copes—Fast and Slow Pouring.

Editor American Machinist:

In your issue of July 22, Thomas D. West, in an article on "Weighting Down Copes," makes some statements that are not correct, and to which I therefore take exceptions. He says: "Solid iron floats on the top of liquid iron, just as ice floats on water."

This is calculated to mislead. Solid iron does no such thing. Clean your iron of all extraneous matter; turn your piece of metal if you will; now thrust it into a ladle of the same metal, and, my word for it, it will not float "just as ice floats on water."

Again: "to say that iron expands so as to occupy more space when it is cold than when it is melted or hot, would be to ignore observable results that occur in almost every casting."

The law of expansion and contraction is constant, whether observed or not. But I venture to say that no one, since Tubal Cain to the present hour, has ever made the statement that the resultant casting, as it leaves the foundry, occupies more space than when it was "melted or hot."

That fluids contract after having reached a specific high temperature, is as certain as that they expand after having reached a specific low temperature.

Raise water above 32°, it begins to expand; lower water from 32°, it begins to expand. Singularly enough, too, the absence of heat (cold) will produce force in equal ratio with its presence.

That cast iron of a high temperature, "Hot," as foundrymen call it, will and does expand after being cast, is beyond peradventure.

Witness the casting of a solid 11″ cannon. The mode is to fill the flask, then with the crane lift a head say 30″ long, and as large as the mold on top, hang four fifty-pound weights to keep in place, and fill that with metal.

Now examine that head an hour or so afterwards, and you will find the head, *by expansion of the metal*, has been raised $\frac{3}{4}$″; nor can it be ascribed to expansion of mold or flask, since if you look next morning you will find the head down tight as a vise, and the flask hotter than on the previous evening. Yes, and that very expansion (not contraction) would leave your casting hollow in or near the center, were head or feeding not provided.

One more quotation:

"For a moulder to say, as some do, that he has a standard rule whereby he can figure up the pressure on a cope, and hence the required weight to hold it down, to my view, is absurd.

The science of hydraulics, demonstrated by experience, proves that: Given height and surface, and application of multiplication, the result will be, not an approximation, but certainty itself.

Specific gravity of water 1000. Specific gravity of iron 7202. Weight your cope; measure surface and height in feet, multiply by 7202. The answer will be in ounces. You may if you choose give weight of cope on side of safety.

"Why," you ask, "on side of safety?"

I answer: Not, surely, because of any "blow" the cope receives from the rising fluid. It receives no blow, in the usual meaning attached to that word.

The liquid flows under the vessel, and if not loaded down, it floats. Precisely so with a cope. From the moment metal flows into a closed mould, pressure commences.

You may pour a plate, say six feet square, with a less or larger number of ladles, in order to pour slow, bring the iron up one foot in your cope, or any number of inches, and your cope will lift *as much* as mine poured with railroad speed.

The counsel that induces any one to "pour slow" panders to the cowardice of the inexperienced, and while it may produce an inferior description of castings, that may, what is called, "It will go." Slow pouring never produced a sound, well-knit grained casting in the world.

Throw in weight of cope additional, if you will, since if you can't "look it up" yourself, it may be "brought up" higher than you desired. JAMES TULLIS.

Portsmouth, Ohio.

Improvements in Locomotives.

At the Niagara Falls Master Mechanics Convention, Wm. Woodcock in his report as chairman of the Committee on Improvements in Locomotives, stated that the past year did not seem to have been one of any very marked progress. However, there were several improvements being tested which would require time to develop their true merits. The failure of the Fontaine locomotive and the Keely motor were commented upon, and the fact recognized that substantial progress had been made by master mechanics in building good reliable locomotives for every-day use in hauling passenger and freight trains.

The experiments of A. B. Underhill upon the Boston and Albany Railroad in constructing boilers for carrying high pressures were fully described. The first of these locomotives built was illustrated and described in the AMERICAN MACHINIST of June 17, 1882. A deflector of fire-brick over the fire-door, as used by Howard Fry upon the Pennsylvania Railroad, consists of running two center tubes from the front sheet of the fire-box to the back sheet directly over the fire-door, instead of into the crown sheet as is customary with these tubes, leaving two side tubes in their usual places; *i. e.*, running from the front sheet of the fire-box to the crown sheet. A row of fire-brick is laid upon the two center tubes, extending from the front to the back sheets of the fire-box. They form a good deflector, by the aid of which a careful fireman can make plenty of steam without producing much smoke.

In England where the consumption of fuel per square foot of grate is much less than in this country, iron deflectors were used, but these plates have been found to last so short a time that they have been abandoned altogether.

The Baldwin Locomotive Works have built two novel engines during the past year, one of which is known as of the "Decapod" class. It has ten driving wheels and a pony truck. The cylinders are 18″ diameter, with a stroke of 20″; driving wheels, 37″ in diameter. Total wheel base 18′ 8″; driving wheel base, 13′; diameter of boiler, 54″; length of flues, 16′ 0½″; length of fire-box, 50½″; width, 48½″; depth, 55½″. The fire-box overhangs back of the driving wheels, and is adapted to burning wood. The other locomotive above alluded to was of the consolidation type for narrow gauge. The fire-box upon this engine also overhangs back of the driving wheels, for burning wood. The cylinders are 16″ diameter, with a stroke of 20″. The driving wheels are 37″ in diameter; total wheel base, 15′ 5″; driving wheel base, 9′ 9″; diameter of boiler, 52″; flues, 13′ 3¾″ long; fire-box, 43½″ long, 48½″ wide and 54½″ deep.

The new steam reverse gear built by the Baldwin Locomotive Works, which was illustrated and described in detail in the AMERICAN MACHINIST of January 28, 1882, was described. The fastest passenger locomotive built at the same works is No. 169, Central Railroad of N. J. This locomotive was also fully illustrated and described in AMERICAN MACHINIST of January 7, 1882. The improved details of this locomotive are novel and valuable for fast passenger service.

The information furnished the committee by W. W. Evans was to the effect that in Peru, on the railroad running from Areguipa to Lake Titicaca, there are 70 miles of road situated upwards of 16,000 feet above the sea level. The bed of the road, nearly its entire length, is solid rock.

L. B. Paxson, of the Philadelphia and Reading Railroad, sent the committee a description of the new Wooten locomotives used upon their road. These locomotives have a fire-box as wide as the tender, with two fire-doors. The house is placed in front of the fire-box. The object of this construction is to get a greater area of fire grate to allow a slower combustion. The driving wheels are placed close together, so that there has been no accidents from the breaking of coupling rods since this class of engine was introduced. The improved steam reverse used upon these locomotives was designed by Mr. Good of the same road.

It consists of a single steam cylinder operated by a single valve. An automatic stop is used to prevent injury to the cylinder heads in reversing quickly. It is said to work very satisfactorily. Attention was directed to the Joy valve gear, invented by David Joy of England. This valve gear has been placed upon locomotive No. 411, on the P. & R. Railroad, and is now running upon regular passenger service between Philadelphia and Bound Brook to test its practical value as compared with the ordinary link motion. This valve gear was described in the AMERICAN MACHINIST of August 5, 1882.

In discussing the report of Mr. Woodcock, the following facts were brought out:

The steam reverse had a thorough exposition, and it was finally concluded that the advantages claimed for it were insufficient to warrant its introduction. Its high first cost was also urged as an objection. The idea of using a steam reverse to shift the links of locomotives was regarded as a sure indication that something must be wrong with the valves. Modern railway practice is to increase the diameters of cylinders and the area of ports, while nothing has been done to relieve the valves.

The proper way to overcome this evil is to go to the root of the difficulty by removing the load from the valves, then the valves and seats will be preserved. The engine will then reverse quite easily, and the durability of all the parts that go to make up the valve motion will be secured. The chief complaint against the steam reverse has been that it would not hold its position, but would creep forward and backward. By removing the pressure from the valves they will remain square much longer, and are far less liable to derangement and annoyance. It is well known that any derangement of the valve gear is attended with a corresponding loss of power and waste of fuel. One of the chief considerations in the construction of high-speed locomotives is the elimination of all possible friction, but in many instances the value of this consideration is too little appreciated. Valves, when once set right, ought to run a year at least without requiring any attention. By relieving the valves of their load many other existing difficulties disappear.

The Pittsburgh Smelting Works, of Pittsburgh, Pa., have decided to locate their new works at Aurora, Ill. The merchants and business men of the latter city have generously given them 125 acres of land at a nominal figure on which to establish their plant. The company state that they will have to expend $200,000 before being ready to commence business. Some idea of the magnitude of the business of this concern may be formed when it is known that they paid last year to one railroad over $500,000 for freight. These works will be a great acquisition to the manufacturing industries of this city.—*Industrial World.*

The Northern Pacific Railroad track is now laid in the Yellowstone Valley a distance of 211 miles west of Glendive. This is within fifteen miles of the important town of Billings, in the heart of Montana. The track is said to be going down at the rate of one and a half to two miles per day.

Sweeps and Spindles.

BY THOS. D. WEST.

Sweeping green and dry sand or loam moulds is a branch of the moulder's trade that calls for higher mechanical qualifications than making castings from a full pattern. Sweeping or bedding in is not extensively done in other than jobbing or machine-shop foundries; hence, only a comparatively few moulders are acquainted with the processes, but since the practice is becoming more common from year to year moulders must in the future give more attention to this part of the trade.

In the cut is shown a rigging for sweeping under the bottom of loam cores. The sweep, seen at the left, is bolted to two iron arms *x x*, which are held up by two collars fastened to the spindle with set screws. The band revolves around, and the spindle remains stationary. The tapering end of the spindle is set into the casting *H*, the outside diameter of which can be from 4″ up to 8″. This casting should be turned up on the outside, true with the chilled inside spindle hole, so as to have a true surface for the lower arm and collar to be placed and worked at any point up or down on it. This casting is bolted to a plate from four to six feet diameter, and the plate is laid level on a solid floor. The loam plate is then set on top of the spindle holder *H*. Bolted to this loam plate is a casting having an upper and a lower flange. In the upper flange there are four staples cast, two of which are shown at *E E*. The inside of this casting is bored out the size of the spindle, and when bolted to the loam plate, as shown, and the spindle passed through it, there is no danger of the loam plate being overbalanced.

Before setting this loam plate on the standard *H*, it is daubed up with loam even with the face of the prickers, and then dried in the oven, so as to have a dry body to absorb the moisture of the loam used to finish it up with when the plates or bottom is swept up as shown.

When this spindle holder or standard is used it is generally for a core that has little or no bearing on the bottom of the mould, but has to be supported from the top as in the cut. The top loam and covering plate is not set on and bolted to the lower plate until the core and a level joint is made and finished with the sweep. This top plate having been previously swept level and dried, requires no sweeping to make it have a true face after it is placed.

After this plate is bolted with four bolts, one only of which is seen, there is a row or two of bricks, *P*, built around on top, and a sweep forms a straight face the same diameter as the one swept on the outside or cheek *W*, so that when the core is lowered down into the mould, a short straight-edge placed against the parallel faces, *P* and *W*, will center the core in the mould.

The staples *E*, *E* and *A*, are for hitching the chains to hoist the core by. The top staples, of which there are four, are the best to hoist by, but should the mould or core be less in height, the lower staples can be used. When the core is finished and hoisted up from the standard *H*, the hole that it leaves in the bottom is filled up and made level with bricks and loam, a piece of plate iron having been first wedged in up against the spindle hole so that the pressure of the melted iron cannot burst up through the bottom when the mould is poured.

When setting this core on the carriage, the bottom is lowered down on a flat plate having on it a bed of dry loam sand for the bottom to rest on.

For other classes of work where all the bottom is not wanted, a standard the same as *H* could be bolted to a carriage, and by having a short spindle, the core or mould could be rested on this, and the carriage run into the oven.

This rigging, for a jobbing shop that does much loam work, can often be used to a good advantage. It could be used for casting short stroke cylinders that have one of the ends cast in, as it is now often done, but by this plan the bottom will be cast down, thereby making a solider head than when cast up.

To form a riser head on a cylinder when this plan is used, the top flange is bricked over and the straight part of the cylinder carried up as high as wanted. When making a cylinder this way the outside should be checked off, and when the cores are set in and fastened, the center core is lowered in. A man with a lamp underneath can guide and see that the center core does not touch any of the port cores. Then the whole mould is set on the bottom by hoisting it by the four cheek handles, one of which is shown at *T*.

The gate shown is for filling the bottom over so that when the iron drops down from the top it will fall into iron and not cut the bottom of the mould.

The cuts *Y* and *R* show two styles of arms. *R* is a style that can be worked tight or lose. When tightened on the spindle by the set screw shown, the spindle must revolve; but when there is a collar screwed to the spindle, as shown at *D D*, the arms are loose and can revolve without turning the spindle.

The latter is the best plan when sweeping with a spindle that works in a tapering hole long enough not to require steadying at or near the top, but when a spindle is held at the top and the bottom works in a small socket, as shown in the octagonal loam mould cut, January 14, 1882, there is very little friction, so that the spindle can be turned when sweeping very easily.

The arm *Y*, is a very handy one to use on a spindle that is made to revolve in sweeping. This arm can be made for one or two keys, but it is best to have two in one to be used for holding heavy sweeps. The advantage of such arms is that they may be taken off and on without disturbing a spindle held at the top.

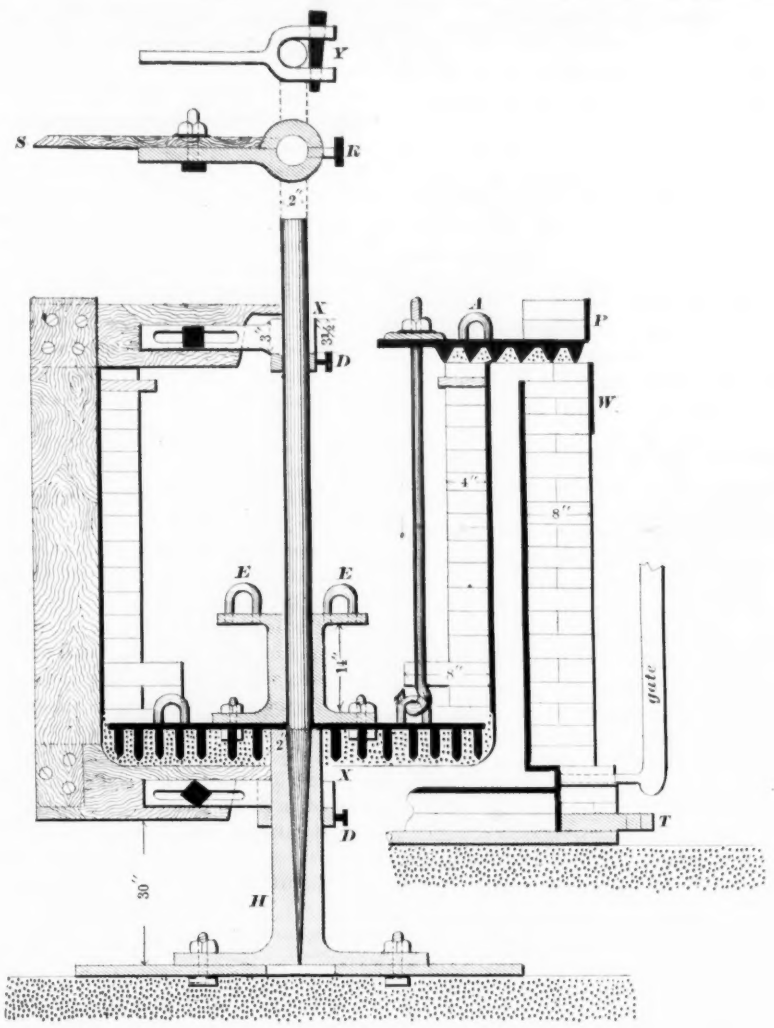
The placing of arms or brackets for holding the top of long spindles steady, is an important detail that is very seldom properly attended to. There are very few buildings but that whenever a crane is turned around will move more or less, and in some shops the loam moulder when sweeping up a long mould has often to sit down and wait until a crane can be turned back the same as when the first coat of loam was swept on. Arms or brackets should not be fastened to unstable buildings, but should be secured to upright timbers sunk deep in the ground and independent of the building altogether. The board or sweep bolted to the arm *R*, is to show how arms should be made. There are shops that have arms made so that a sweep when bolted to them will not have the working edge *S* on a true line with the center of the spindle. This causes trouble in setting the sweeps and getting the right diameter for a casting.

In making spindles they should be made even inches diameter, otherwise they are apt to cause mistakes in making and setting sweeps. Two inches diameter makes a handy spindle for ordinary sweeping, and for fine work they should be made of steel, turned up true. The larger sizes of spindle are often made of wrought iron tubes, or of hollow cast iron.

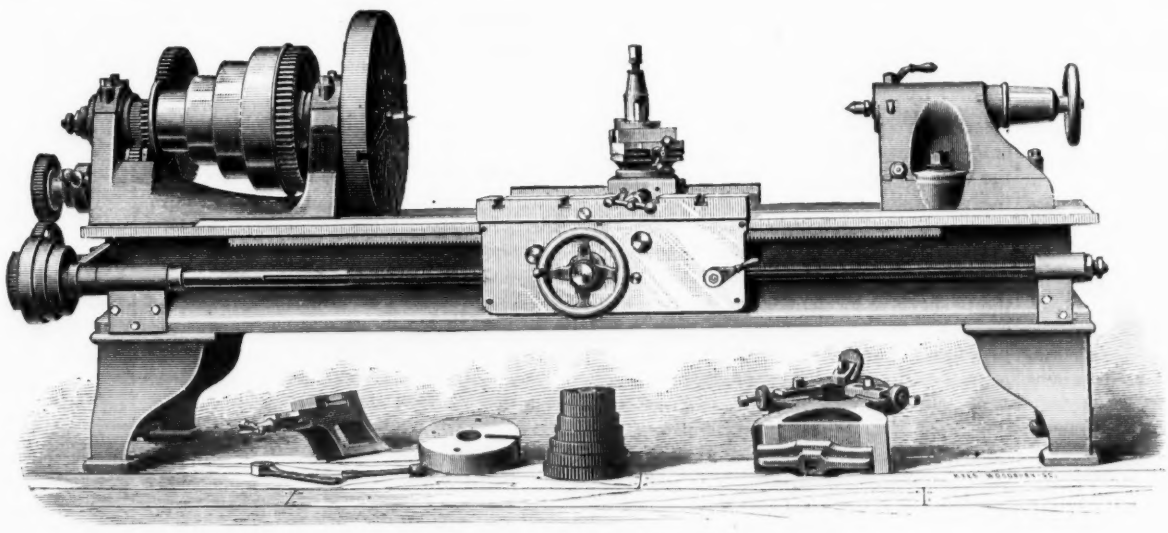
The spindle holder for sweeping green sand moulds, that have been shown so many times, but never explained, is a flat plate about 24″ diameter, and the tapering hole for the spindle to fit into is about 10 inches long. When casting this, the tapering end turned on the spindle is used for a chill, being set in the open mould and the iron poured around it. When cold, the spindle is knocked out, and when put in again, to use for sweeping, you can rely on having a steady spindle. The collars should be used on this spindle so that the arm and sweep can revolve without having the spindle turn. This makes a very handy rigging for sweeping green sand moulds, as the spindle seat or holder is light and can be quickly set in any part of a foundry floor.

The tapering end of this spindle should always be well oiled before it is set in, as otherwise the damp sand and steam is liable to rust it.

As the sweeping of green sand moulds is generally done to save pattern making, the proprietor as well as the moulder has the advantage over others, when he can make a casting with sweeps that others could not make without having a full pattern to work with, and in cities or places where competition is active, a good knowledge of sweeping in all its branches will be of value to the proprietor and moulder alike.



Improved 26-inch Swing Screw-Cutting Engine Lathe.



IMPROVED ENGINE LATHE.

The engraving presented herewith represents an improved engine lathe built by A. M. Powell & Co., Worcester, Mass., to meet the demand for a heavy, strong-running and convenient tool of this class. Although nominally a 26-inch swing, this lathe really swings 27″ over the ways and 16½″ over the carriage. It is made with any length bed required.

The spindle is of hammered cast steel, with a front bearing 4½″ diameter and 6″ in length, giving steadiness to work being done on the face plate or in the chuck and a large wearing surface to preserve the alignment of the spindle.

The cone has four changes for a 3¾″ belt, and the head and back gearing are not only arranged for a powerful motion, but for equal gradations of speed throughout, avoiding the abrupt jump too frequently found between the cone and gear speed.

The screw gearing is used only for cutting screws, the feed being independent by means of cone feed pulleys and splined screw.

The carriage is gibbed and has compound tool block with adjustable automatic feed. T slots in the carriage provide for clamping work for boring, or for other purposes.

All spindles, screws, studs and pinions are made of forged cast steel; all sliding parts are scraped to fit without the use of emery, and all the parts liable to be bruised are protected by being case-hardened.

A countershaft, fitted with pulleys 18″ in diameter, together with center rest, wrenches, etc., is furnished. Each lathe is set up and fully tested before leaving the works, and is fully guaranteed. The weight of this lathe, with 10-foot bed, is 5,500 lbs.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

Horace B. Miller, Prest.

Jackson Bailey, Vice-Prest.

Lycurgus B. Moore, Treas. and Sec'y.

96 Fulton Street, New York.

Jackson Bailey, Editor. Horace B. Miller, Business Manager.

Lewis F Lyne, F. F. Hemenway. } Mechanical Engineers.

The American News Company,

Publishers' Agents, New York.

The International News Company,

11 Bouverie street, (Fleet St.) London, Eng.

Will receive subscriptions for the American Machinist at 16/8 per annum, postage prepaid.

DEALERS SUPPLIED BY

The American News Company, New York.
The American News Company, Denver, Col.
The American News Company, Kansas City, Mo.
The American News Company, Omaha, Neb.
The American News Company, St. Paul, Minn.
The New York News Company, New York.
The National News Company, New York.
The New England News Company, Boston, Mass
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St. Louis News Co., St. Louis, Mo.
The Cincinnati News Company, Cincinnati, Ohio.
The Detroit News Company, Detroit, Mich.
The Pittsburgh News Co., Pittsburgh, Pa
The Baltimore News Company, Baltimore, Md.
The Rhode Island News Co., Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The Brooklyn News Company, Brooklyn, N. Y.
The Williamsburgh News Co., Brooklyn, E. D., N.Y.
The Newark News Company, Newark, N. J.
The Northern News Company, Troy, N Y.
The Albany News Company, Albany, N Y.
The Washington News Co., Washington, D. C.
The Montreal News Company, Montreal, Canada.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

$3.00 a year, in advance, postage prepaid in the United States and Canada.
$4.00 to Foreign Countries, postage prepaid.

ADVERTISING.

Transient, 35c. per line each insertion.
"Business Specials," 50c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, AUGUST 19, 1882.

CONTENTS.

PAGE

New Combined Steam Excavator and Derrick Car 1
Portable Engine Refinements. By F. G. Woodward 2
Indicator Rig of the Steam Yacht Namouna. By L. F. Lyne 3
New Steam Engine 4
Tires of Mixed Metals 4
A Monument for a Great Engineer 4
Improved Slotting Machine 5
Letters From Practical Men—Raw Spots in Steam Boilers—Babbitting—Weighting Down Copes—Fast and Slow Pouring 5, 6
Improvements in Locomotives 6
New 26-inch Engine Lathe 7
Sweeps and Spindles. By Thomas D. West 7
Industrial Co-operation 8
A New Catechism 8
Literary Notes 9
Questions and Answers 9
Manufactures 9
Machinists' and Engineers' Supplies 10
Iron and Metal Review 10

Industrial Co-operation.

One of the toughest problems of the day is to mark out some way for the ambitious, upright, and industrious artisan to start himself in business, after mastering his trade, without the requisite capital to found an establishment of his own. This problem has more knotty points than the selection of a trade, and the acquirement of the skill necessary to pursue it successfully, from a mechanical point of view. No matter how persevering and frugal a mechanic may be, it will take many years to save enough from his daily or weekly earnings to fit up a machinery establishment to compete in making, say steam engines or steam pumps, with old-established houses possessed of abundant resources. Manufacturing both large and small articles is now being done mainly on a larger scale than it was ten, or even five, years ago, and the tendency is to concentrate the business into fewer and larger establishments.

With this situation and future prospects in view, we see strikes and labor combinations upon every hand actuated by the one central idea of securing higher wages. These efforts, of course, fail wherever enough men are found to work at the rates of wages offered. Strikes will never solve the problem, for the result is generally a pecuniary loss whether the strikers gain their object or not. Its solution must be looked for in another direction.

Let us suppose it requires ten thousand dollars to fit up a shop to employ twenty-five skilled workmen. The individual who has that amount of capital coupled with the necessary business ability, can secure, by usual methods, the men who have the needed skill, and can run the shop successfully without himself possessing any skill as a workman. Now, reverse the proposition and assume that there are twenty-five competent mechanics who wish to start a shop, costing ten thousand dollars to fit up to make some specialty that is likely to meet with a good demand and yield fair profits. Can they obtain the capital? It requires just four hundred dollars each, and we contend that if they possess ordinary thrift they can provide the money by laying out plans in advance, and each working to secure his share of the resources for the purpose needed.

Industrial progress and independence are achieved by industrial co-operation, no less when a great trunk line of railroad is to be built and equipped than when a shop is to be fitted up and run by an association of earnest, ambitious mechanics. The great need of the times is for skilled artisans to study well the principles that underlie industrial association, and act upon them.

We will continue our illustration by supposing the capital to have been raised among the twenty-five mechanics and the shop fitted up for doing the work it was intended to turn out. Another requisite of success now confronts the beginners. One, two or more men (depending upon the extent of operations) must be at the head of the business, who are positively known to have the right kind of ability and experience to manage it. A neglect of this element has caused the ruin of most of the co-operative establishments that have gone out of existence. The buying and selling and the regulating of work require skill no less than the designing and building of a machine, but of a different kind. It no more follows that an expert mechanic can safely assume the position of a business manager, than because a man can successfully conduct a business it follows that he can safely fill the place of an expert mechanic. Co-operative associations should at the outset take into membership at least one man known to have the ability and experience needed to manage the businss properly, whether that man has any mechanical skill or not, and they should elect him to that position with all the powers that managers of stock companies are usually permitted to exercise. There are plenty of examples of successful establishments started on this plan, to encourage those inclined to try it.

We have seen evidences enough this season that workmen can associate themselves by thousands into one organization, pay their money into a general fund and follow harmoniously the directions of their elected managers. With one-half the confidence and enthusiasm often displayed in trades unions, competent artisans could found workshops by associations and conduct them successfully.

It would seem to be wise for employers to encourage the development of co-operative manufactories, each in specialties that would not conflict with his own. Employes working with that end in view would be more profitable to engage and doubtless more to be relied upon. The plan offers the most effective remedy for strikes that we can suggest.

The familiar story of the Irish captain, who was obliged to take the weather as it came, as the penalty for sailing without an almanac, suggests the idea of moderating the temperature by suitably adjusted thermometers. One morning during the recent "hot spell," when the mercury had the habit of crawling up to the neighborhood of 100°, we took occasion in the forenoon to consult several thermometers exposed for sale and found them to record 94°, 95°, 96°, 97° and 98° respectively, and as a matter of course felt uncomfortably warm—especially with the prospect of an increase of 15° some hours later. Investigating a little further, about two feet from the others an old standard regulator was discovered against the wall coolly marking 87°. We took the weather by the lowest figures for the remainder of the day.

A New Catechism.

We are asked by an esteemed Western correspondent a series of questions—30 in number—which, from the space they would occupy, no less than from the character of some of them, we cannot answer in the room devoted to Questions and Answers. As our correspondent seems to be in earnest in search of information, we will, however, do the best we can for him.

Q.—Is the Keeley motor alive yet?

A.—So far as we are aware, the motor named never showed any other signs of life than an occasional kick. We believe it is still made to display that evidence, although the most of the kicking seems to be done by the stockholders.

Q.—Are there any patents on perpetual motion?

A.—A good many in principle, but not under that name.

Q.—Do you believe in mind reading?

A.—Never having had occasion to investigate the subject, we regret to say we have not formed an opinion.

Q.—What constitutes a working day in England?

A.—We understand, generally speaking, 10 hours, but there is an abatement Saturday, varying somewhat in extent in different localities.

Q—Is Phrenology considered an exact science?

A.—It is so considered by some, while others for "science" substitute the word humbug.

Q.—How long a time do you consider proper for an apprenticeship; 3, 4 or 5 years?

A.—Our opinion is that this should depend on the character of the trade, and to some extent on the age of the apprentice.

Q.—What substances in boilers are most injurious to the iron?

A.—Acids.

Q.—What kind of steel, wrought and cast iron, are the strongest?

A.—Cast steel, and the best brands of American iron.

Q.—What technical papers in this country have the largest circulation?

A.—Our correspondent will excuse us, on the plea of modesty, from answering this question.

Q.—Can anything be added to cold water to help to cool a journal?

A.—Common salt is sometimes added.

Q.—How many kinds of motors are in actual use?

A.—The motors in practical use are operated by water, steam, air, gas or electricity.

Q.—What kind of power would you advise for a small shop?

A.—That would depend entirely upon circumstances, such as cost of fuel, cost of water, &c., &c.

Q.—Is the Machinist's and Blacksmith's Union a good organization for a young machinist to join?

A.—We are not acquainted with the aims and objects of the association—hence are not competent to advise.

Q.—Can a complete list of the technical journals, published in this country, be obtained, and if so, where?

A.—The Newspaper Annual, published by N. W. Ayer & Son, Philadelphia, has such a list.

Q.—Would there be much gained by making a small marine engine and boiler entirely of steel?

A.—Not much; a little in weight.

Q.—Is there anything that will assist in keeping metal cool when exposed to heating conditions?

A.—A good conductor of heat may be made to assist.

Q.—Do you think a Saturday afternoon half-holiday will ever be granted to mechanics in this country?

A.—This is purely a matter of speculation, with reference to which our opinion has but slight value.

Q.—Do you think it would pay to publish an illustrated book on tools, with a short description of each?

A.—If the book possesses originality and positive merit, yes.

Q.—Do you think our manufacturing interests would suffer by competition with foreign countries if our working day was reduced to 9, or even to 8 hours?

A.—Probably to some extent, for a time at least.

Q.—Does any book contain information about the qualities of water (salt and fresh), in the different countries in the world?

A.—No, not that we are aware of.

Q—How long a time can a steam gauge in constant use be depended upon without testing?

A.—That depends upon the quality of the gauge, and the usage it receives. For some we should say, under any circumstances, not more than fifteen minutes; for others, a year.

Q.—Is there an instrument, similar to the salinometer, for testing the impurities in water?

A.—No.

Q.—Do you think a water purifier could be made that would supply a boiler with pure water?

A.—We shall not say that this cannot be done. We can only say that it has not been done.

Q.—Don't you think that constantly adding improved machinery will result in over-production?

A.—No. The demand for something better is without virtual limit.

Q.—Do you consider it sufficient to clean a stationary boiler once a month, under ordinary circumstances?

A.—Where good water is used, and the boiler is not overworked, cleaning once a month may be sufficient.

Q.—What kind of coal is considered the most economical to use for making steam?

A.—It depends entirely upon circumstances, such as the cost of different kinds of coal in different localities; the kind of boiler used, etc., etc. There can be no general answer to this question.

Q.—Do you think the marine engine will ever succeed in driving sailing vessels from the ocean?

A—No.

Q.—Is the exhibition at Denver, Col., international?

A.—No.

Q.—What regulates supply and demand?

A.—Apparently railroad combinations, stock and grain speculations and trades unions have a great deal to do with it. Natural causes, like the effect of good or bad weather upon growing crops, have a minor regulating influence.

Literary Notes.

MANUAL OF THE RAILROADS OF THE UNITED STATES FOR 1882. (15th Annual Number.) H. V. & H. W. Poor, 70 Wall St., New York. Price $5.

The appearance of Poor's Manual is looked for every year with absorbing interest by the great body of people who are especially interested in railroads. It is the only compendium showing the mileage, stocks, bonds, cost, traffic, earnings, expenses and organizations of each railroad company in the United States and Canada, with a sketch of its rise, progress and influence. The volume before us contains a thousand pages of manual and a hundred and fifty pages of advertisements. Information seems to be gathered down to about the 1st of June. An Appendix gives a summary of State debts and of the United States debt with a list of the different classes of bonds. The introduction to this volume is quite profuse in statistical comparisons and speculations as to the future of railroads in this conntry. Among other things it says: "The railroad mileage in the United States rose from 52,914 miles in 1870 to 104,813 miles in 1881. At a similar rate the mileage in it in 1890 will exceed 200,000 miles. It will probably largely exceed such estimate. Railroads in this country precede the movement inland of our population, in order to provide the means for such movement, and outlets for its products. The rapid increase of the population of the country is a most favorable feature for these works. The annual increase from 1870 to 1880 was 1,200,000, the annual rate being 33 per cent. At the same rate the annual increase from 1880 to 1890 will be 1,650,000, the total population in 1890 reaching 65,000,000. The rate of increase the present decade will probably exceed that for the one just passed, from the enormous immigration into the country from almost every part of the world."

ROCKS, MINERALS AND STOCKS, is the suggestive title of a volume nearly ready to be placed before the public by the publishers of the *Railway Review*, Chicago, Ill. Contents are to be as follows: Part I. World Building, Prime Minerals and Rocks; The Formation. Part II, Gold and Silver; Industrial Metals; Coal and Oil; Industrial Minerals; Precious Stones. Part III, Stock Companies; Stock Dealing; Stock Tricks. If the work fulfils the expectations raised by the above outline of contents, it will be just what is wanted by thousands of manufacturers and investors in mining stocks, who cannot spend the time to search voluminous geological and financial treatises. It will be sold in paper covers for 75 cents, and bound in cloth for $1.50.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(273) Y. F., Worcester, Mass., asks: Of what is German Silver for fine work composed? *A.* A very fine article is made of 8 parts of copper, 3½ parts zinc and 3 parts nickel.

(274) M. T. T., San Francisco, Cal., asks: Will you please inform me how small malleable iron castings are made? *A.* The castings are made from the best brands of cold blast charcoal mottled iron, and then put through a cementation process in cast iron boxes, being packed in with layers of powdered red hematite ore, or sometimes with scales from the rolling mill, and heated to a red heat in the annealing furnace.

(275) A. J., Plainfield, N. J., writes: I have succeeded in inventing a simple self-acting coupling for railway and other cars, and wish to ask in what countries it is best to patent it. *A.* You have done what a thousand others have done, and on general principles our advice is that you keep your money instead of paying it for a patent that will in all probability be worthless.

(276) W. G. S., Greenville, Iowa, asks: 1. Suppose I wish to run an engine at a given speed, how shall I determine what diameter pulley to use on the governor shaft? *A.* Use a pulley that will drive the governor the speed marked on it by the manufacturer. 2. At what speed should a drill press be geared to run? *A.* That will depend entirely upon the work you wish to do. Gear it so at its slowest speed it will run slow enough to drill the largest hole you wish to drill.

(277) H. A. S., Charlotte, Me., asks: 1. Suppose I obtain a patent embracing several improvements on a mowing machine, one of the parts improved being the pole; would my patent give me control of the use of the improved pole on other machines, such as harrows, etc., or would it be necessary to obtain a separate patent for the pole? *A.* You should obtain a separate patent on the pole. 2. If a 3″ wrought iron shaft carrying a wheel weighing one ton runs at 100 revolutions per minute, will it do as well running on rollers arranged like a patent tackle bushing as it will in cast iron boxes? *A.* No.

(278) F. W., Philadelphia, Pa., asks: Will you please inform me if a balance wheel produces any power? I learn that centrifugal force may be very small near the center, but will be increased away from the center. Also that it will be increased in proportion to the speed and weight, and I want to know if a balance wheel will take any resistance from a machine so that it will run with less power? *A.* No. A balance wheel is in mechanics simply a necessary evil. So far from producing power, it consumes power by its resistance to being put and kept in motion.

(279) W. W. H., Renovo, Pa., asks: Which will wear best, a driving box brass filed with a coarse file or one that is scraped smooth? *A.* A journal and box when in working condition should both be smooth, but however well they may be fitted, when at work the conditions will be slightly changed, so that some wear is necessary to bring the journal and box to a perfect fit. It is claimed by many engineers that by filing the brass across the direction of the wear, that when put to use the journal and box will wear better than if a perfect fit is made in fitting up, and within certain limits this is probably true.

(280) C. E. B., Catasauqua, Pa., writes: I have had some trouble with double beat locomotive valves. Do you think the bottom seating should be ground more than the upper one, or that the difference in expansion between the valve and the casing will cause the valve to leak? *A.* There is no certain way of making a double-beat valve tight (unless made with one spring face) except to fit it under the working pressure. There will be a difference in expansion from heat, and a springing of the casing under pressure that will cause a leak. In some cases grinding the lower seat the most may help it, and in other cases it may be better to grind the upper seat the most. This must be determined by experiment.

(281) J. B. G., Knoxville, Tenn., writes: I had a job of making two gears to match and run 2 to 1, 3⅜″ centers. I calculated the dimensions, according to Prof. MacCord's rule in the AMERICAN MACHINIST, to be as follows: Pitch diameter of large wheel 4.50″; pitch diameter of small wheel 2.25″; large wheel, 50 teeth; small wheel, 25 teeth; diametral pitch, 9; circular pitch, .28″; total diameter of large wheel, 4.70″; total diameter of small wheel, 2.45. A friend of mine calculated the sizes as follows: Pitch diameter of large wheel, 4.50″; pitch diameter of small wheel 2.45″ [?]; large wheel, 52 teeth; small wheel, 26 teeth; total diameter of large wheel, 4.66″; total diameter of small wheel, 2.41″ Which is correct? *A.* The pitch diameters would be as you have them; viz: 4.50″ and 2.25″. The diametral pitch, if made with 50 and 25 teeth, would be: 50÷4.50=11.11 and the corresponding circular pitch 3.1416÷11.11=.28″. The total diameter, according to the rule quoted, would be 4.50″+.20″=4.70″, and 2.25″+.20″=2.45″. If made with 52 and 26 teeth, the diametral pitch would be. 52÷4.50=11.55, the circular pitch 3.1416÷11.55=.27″, and the total diameters 4.50″+.19″=4.69″ and 2.25″+.19″=2.44″.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

F. Samuelson, Pattern Maker, 38 Gold St., N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

"Steam Economy," 124 pp., cloth, $1.00 (illustrated), points out remedies for defects in engines. Best indicator practice. A. Wilkinson, 123 n. 4th St. Phila.

Mechanical Engineering.—To learn inventing, designing and construction of machinery at school. Address, S. W. Robinson, Ohio State University, Columbus, O.

Eelskin Belt Lacings specially prepared. Machines run steady. No pounding of boxes. Outwear all other lacings. Send for circular, New England Belt Lacing Co., New Haven, Conn.

We will pay 25 cents each for copies of the AMERICAN MACHINIST for January 1, 1881, which are clean and in condition for binding. American Machinist Publishing Co., 96 Fulton street, New York.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users and engineers. [Mention this paper.]

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

"Sibley College of Mechanic Arts, Cornell University.—Entrance examinations will be held June 12th and September 11th, 1882. For the register and catalogue just issued, containing reorganized courses of instruction, scientific and practical, including draughting, machine construction, general shop work, etc., apply to the President of Cornell University, Ithaca, N. Y."

If you desire to keep pace with the daily progress and development of Telephone, Telegraph and Electrical matters, have a copy of the NEW YORK REVIEW OF THE TELEGRAPH AND TELEPHONE sent to your address. Only $2.00 per annum. George Worthington, Editor and Proprietor, No. 23 Park Row, New York. P. O. Box 3329.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

Rocks, Minerals and Stocks; by Frederick H. Smith, Consulting Engineer and Geologist. Contents: Part I. World Building, Prime Minerals and Rocks, the Formation; Part II. Gold and Silver, Industrial Metals, Coal and Oil, Industrial Minerals, Precious Stones; Part III. Stock Companies, Stock Dealing, Stock Tricks. *A vade mecum* for the use of everyone interested in these important topics. Scientifically accurate, witty, fascinating. *Sui generis* among technical books. Handsomely bound in cloth, $1.50, in paper, 75 cents. Order through your bookseller, or address The Railway Review, 182-184 Dearborn St., Chicago, Ill.

To Machinists Pattern-Makers and Millwrights—I have compiled the most complete table of the diameters of Pitch Line of Toothed Wheels ever published. This table supplies a long-felt want, as the numerous testimonials I am receiving will attest. The table is very complete in every particular, and from it you will get a result at a glance without calculating. No algebraic terms are used; it gives the pitch line of toothed wheels from ⅛ to 4 inches pitch, and from 12 to 100 teeth. Third edition now on the press. Orders promptly filled. Price, $2.00. Address, Wm. T. Ross, First and Washington streets, Louisville, KY.

MANUFACTURES.

H. & F. Blandy, Zanesville, Ohio, are to enlarge their iron foundry.

A tubular rail company, with a capital stock of $1,000,000, is talked of at Chicago.

J. Chatterton & Co., Cleveland, Ohio, have built a new shop 80x30, and filled it with improved tools for the manufacture of steam boilers.

Palmer & DeMoody, Cleveland, Ohio, have started a new foundry at the corner of Leonard and Merwin streets.

The Vulcan Iron Works, Toledo, Ohio, are building a new boiler shop, 100x80, to be fitted with improved machinery including a power riveter.

The Globe Iron Works, Cleveland, Ohio, are increasing their capacity by erecting a three-story brick building 120x101.

C. E. Lipe, Syracuse, N. Y., will exhibit his new universal milling machine at the Cincinnati Industrial Exposition this year.

The Betts Machine Co. of Wilmington, Del., has just sent out another large Planing Machine—this time a machine to plane 8 feet by 8 feet by 20 feet which weighs upwards of 70,000 pounds. It goes to the well known house of Mackintosh, Hemphill & Co., Limited, Pittsburgh, Pa., who have for years been using a machine to plane 10 feet by 10 feet by 30 feet made by the same firm.

The Hancock Inspirator Company whose head office and manufactory is at Boston, report sales of over 35,000 inspirators in the past four years. They employ 125 hands and have a monthly product of 1,500.

The offer of Z. A. Taft to give all the land necessary for the works of the Wilder Screw and Machine Co., near the railroad depot, Uxbridge, Mass., has been accepted and the works will be located there.

The new foundry and shops of the South Pueblo, Col., Machine Company are completed, 128x50, and the engines and boilers are in place and the machinery and shafting being put in. The cupola and foundry are ready for business.

The Western Automatic Machine Screw Company, at Elyria, Ohio, manufacturers of set and cap screws, and hand and machine taps, are building 70x22 for office and storeroom, 64x35, two stories, for machine shop, to be fitted with new machinery.

The plans have been prepared and sites located for the shops of the Chicago & Atlantic Railroad at Huntington, Ind. These improvements will consist of a round-house, machine shops, blacksmith and boiler shops, repair and paint shops, together with the division offices and supply store.

The Emery Scale Co. has been organized in Stamford, Conn., with Henry R. Towne, President, and A. H. Emery, Vice-President, to build scales and testing machines under Emery's patents.

The Ashcroft Manufacturing Co., 111 Liberty st., New York, have just issued a new illustrated catalogue and price list of 56 pages, containing descriptions of the various tools and appliances manufactured and sold by them. This catalogue is well arranged and fully indexed so that any article contained therein may be readily referred to.

At the proposed new shops of the United States Rolling Stock Company in the Calumet region, near Chicago, it is intended to turn out about twenty cars per day, and give employment to about 1500 men. The Urbana shops will not be dispensed with, however. The new company will have a capital stock of $6,000,000.

D. Saunders' Sons, Yonkers, N. Y, have just shipped a No. 7 pipe threading and cutting machine to John Simmons, Center street, New York, for pipe from 4 to 12 inches. They are well supplied with orders for pipe machinery which is their exclusive specialty. Recently several machines were shipped to California.

Schaffer & Budenberg, represented by W. Heuermann, 40 John st., New York, have just issued an illustrated circular of their new exhaust injector (illustrated in a recent issue of the AMERICAN MACHINIST), showing its various applications with prices appended. This circular also contains tables of capacities, sizes of pipes and other data pertaining to the practical working of their injectors.

The Niles Tool Works, Hamilton, Ohio, write us: Considerable has been said during the past few months about the sale of English tools in this country. We have an item to offset some of these items. We have just received an order from Scotland for a large number of tools. Among them a 10 foot Boring and Turning Mill, 24″ shaper, 7-foot Radial Drill, Planer, Drill Presses, Hydrostatic Wheel Press, etc.

The Jarvis Furnace has lately been applied to boilers of the Monadnock Manufacturing Company, Claremont, N. H.; Edison Electric Light Company, Chicago; Ware River Woolen Company, Barre Plains, Mass., (to use wet sawdust); W. F. & F. C. Sayles, Pawtucket, R. I., (the seventh order); Boston Rubber Shoe Company, Melrose, Mass. The last-named establishment is setting eleven boilers built by the Whittier Machine Company, with this furnace.

The Norwalk, Conn., Board of Trade is making an effort to secure the location in that place of the Wilson Sewing Machine Company of Chicago. It is said that the company manufacture about 95,000 machines a year. The total amount of cash capital required is $250,000. Of this sum $100,000 would be expended for land and buildings, leaving a working capital of $150,000. The people of Norwalk are asked to subscribe $50,000. A committee has gone to visit the works at Chicago and see that everything is as represented.—*Boston Commercial Bulletin.*

David N. Melvin has started a foundry and machine shop under the title of Staten Island Iron Works, at Port Richmond, N.Y. As a consulting engineer he will give his attention to designing, drawing plans for and superintending the erection of new manufactories and reconstructing those already in operation so as to insure the greatest production with the least expenditure of labor and material. The construction and repair of machinery in general and the building of steam machinery will be a specialty. Iron and brass castings will be supplied on orders. Mr. Melvin will also indicate steam engines and examine and test boilers. He has over 25 years' experience as an engineer and stands well in the profession.

Some months ago the Tanite Co. received an order from one of the foreign governments for a solid emery wheel 36″ in diameter and 8″ in thickness. A wheel of this size weighs about 800 pounds, and its list price is $500. A few weeks since the company received a cable order from their Liverpool house for a special machine on which to run this immense wheel. They are now constructing this machine, which is the largest they have yet built. It is from an entirely new design, and will weigh, when complete, 2,200 pounds. The company received last week an additional order from the same government for nearly $3,000 worth of solid emery wheels. Notwithstanding the recent enlargement of their works and increase of hands, they are kept busier than ever.—*Stroudsbury (Pa.) Jeffersonian.*

A correspondent writes us from Freeport, Ill.: "The Freeport Malleable Iron Co. have just put under roof an addition to their foundry 170 feet by 62, and have ground broken for another building 200 by 60 feet, to be used for blacksmith shop, tumbling, cooling room and metal pattern room. Their present facilities came far short of their orders. The Heney Buggy Co. are putting additions on both the north and west side of their shop. They have put in frames but cannot yet fill all their orders Four years ago J. W. Heney was building buggies in a country shop by the half dozen. Now the Company builds by the thousand, and have about 125,000 dollars capital invested. The pipe is here and will soon be laid for the city water works. M. Lanves has purchased the old woolen mill property, built a large foundry, fitted up the old part as a machine shop and will be turning out feed mills soon. The Storer Mfg. Co. put an addition on their machine shop last spring, but are not able to fill much more than half their orders for barb-wire machinery."

Machinists' and Engineers' Supplies.

NEW YORK, Aug. 3, 1882.

Orders begin to increase in size, and goods are stiff at present prices.

Wrought iron pipe is stiff at 57½ per cent. discount from list.

The Pig Iron market continues quiet with a fair volume of business, and supply and demand evenly balanced. We quote prices as follows: Foundry, No. 1, $26 to $26.50; Foundry, No. 2 X, $23.50 to $24.50; Grey Forge, $20.50 to $21.50. Foreign Iron is quiet, with prices firm. Coltness, $26,50 to $27.00; Glengarnock and Summerlee, $24.50 to $25.00; Gartsherrie, $26.00 to $26.50; Copper continues dull at 18¼c. to 18¼c.; Banca Tin, 28c.; Straits and Malacca, 25c. to 25¼c.; Billiton, 25c. to 25¼c.; Spelter 5¼c. to 5 6-10c.; Lead, 5¼c. to 5.15c.; Antimony, 11¾c. to 13¼c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Situation wanted by a thorough practical machinist, as Draughtsman or Pattern-maker, 15 years' experience. First-class references. F. H., AMERICAN MACHINIST.

Wanted.—A superintendent for a first-class establishment working 250 men. Must be well up in all departments and have a thorough knowledge of automatic cut-off steam engines. Address, Competent, this office.

A mechanical engineer, at present manager in a machine tool manufacturing business, will soon be at liberty and desires a position. Is well up in stationary engine, tool and general designing and construction. Address A. J., Box G, Auburn, Me.

Mechanical Draughtsman, used to general work, able to design automatic machinery, desires engagement. Has had experience in the workshop and is technically educated. Distance no object. P, AMERICAN MACHINIST.

40-inch lathe for sale. One 40-inch x 12½ foot screw-cutting, Hewes & Phillips lathe. Will be sold cheap in first class order. Ohl & Co., East Newark, N. J.

NUT TAPPING MACHINE.

DURRELL'S PATENT.

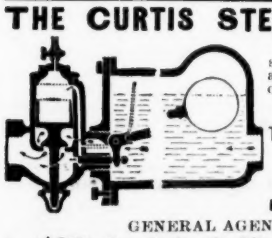
No. 1 Machine, 900 lb., 7 spindles.
" 2 " 1,050 " 7 "
" 2 " 600 " 3 "

Capacity of 7 Spindles, 8,000 per 10 hours.

Acknowledged to be an indispensable tool Manufactured by

HOWARD BROS., Fredonia, N. Y.

THE CURTIS STEAM TRAP.



Send for Circular stating advantages and superiority over other traps.

Manufactured by

THE CURTIS REGULATOR CO

59 Beverly St.

BOSTON, MASS.

GENERAL AGENTS:

A. ALLER, New York, 109 Liberty St.
JOHN McKAY, JR., Philada., 135 North 3d St.
EDW'D J. MOORE, Baltimore, 8 South St.

CLARK'S COMBUSTION OF FUEL.

Fuel: Its Combustion and Economy, consisting of Abridgments of Treatise on the Combustion of Coal and the Prevention of Smoke. By C. W. Williams; and the Economy of Fuel, by T. S. Prideaux, with extensive additions on recent practice in the Combustion and Economy of Fuel: Coal, Coke, Wood, Peat, Petroleum, &c. By the editor, D. Kinnear Clark, C. E. 12mo, cloth. $1.50.

D. VAN NOSTRAND,
23 Murray and 27 Warren Streets, N. Y.
*Copies sent by mail, postpaid, on receipt of price.

HOLROYD & CO.

WATERFORD, N. Y.

Manufacturers of

Stocks and Dies,

For MACHINISTS, BLACKSMITHS & GAS FITTERS.

The Second Grand Exhibition Fair

OF THE

New England Manufacturers' and Mechanics' Institute

Will be held in THEIR MAMMOTH EXHIBITION BUILDING, (the Largest in the United States),

In Boston during the months of September & October, 1882.

Affording the best opportunity for advertising, or of introducing to the public new inventions. Artists, Inventors, Producers, Mechanics and Manufacturers, from every nation, invited to contribute. The product of New England's hand and brain will be well represented. No charge for space. Blank forms for application to exhibit furnished free, upon application to

JOHN F. WOOD, Treas.,
38 Hawley Street, BOSTON, MASS.

Machinery for Sale.

2 15 in. by 6 ft. Back geared, screw cutting Lathes.
2 18 in. by 6 ft. " " " " "
20 in., 26 in. and 30 in. Prentice Drills.
10 in., 15 in. and 25 in. Gould and Eberhardt Shapers.
1 No. 1 Davidson Steam Pump.
1 72 in. Cupola Bottom.
1200 ft. of 16 lb. English T Rails, with splkes, in bond

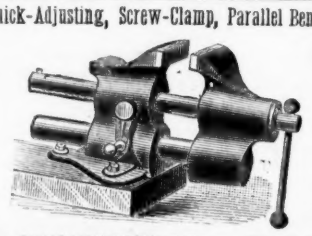
ALL OF ABOVE ARE ENTIRELY NEW AND OF BEST MAKE.

The Cupola Bottom and Rails will be sold very cheap.

For further particulars address

COOKE & CO.,
12 (Old No. 6) Cortlandt St.
NEW YORK.

New Quick-Adjusting, Screw-Clamp, Parallel Bench Vise.

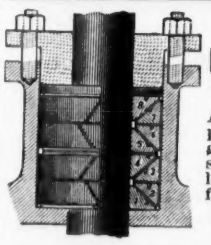


Parts interchangeable. Steel Shafts, Screw and handle.

A strictly first class machine tool. Compact, rigid, strong, convenient

Address, JOHN THOMSON, 9 Spruce St., N. Y. City.

VOLNEY W. MASON & CO.
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.



KATZENSTEIN'S Self-Acting
METAL PACKING
For Piston Rods, Valve Stems, &c.

Adopted and in use by the principal Iron Works, Engine Builders and Steamship Companies within the last eight years in this and foreign countries.

L. KATZENSTEIN & CO.
169 Christopher St., N. Y.

CONCAVE MOULDING CUTTERS,

For Cabinet, Car and Mill Work.

Also Reversible MOULDING MACHINES.

Manufactured by

MORRIS L. ORUM,
448 North 12th St., Philadelphia, Pa
☞SPECIAL MACHINERY TO ORDER.

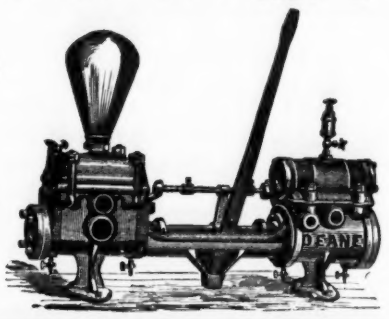
"THE DEANE" STEAM PUMPS FOR EVERY SERVICE.

Send for New Illustrated Catalogue.

:o:

The Deane Steam Pump Co.
HOLYOKE, MASS.

92 & 94 Liberty St., New York. 54 Oliver St. Boston. 226 & 228 Lake St., Chicago.



FOUND

THE STEAM PUMPS made by Valley Machine Co., Easthampton, Mass., are the best in the world for Boiler Feeding and other purposes.

STATIONARY ENGINE DRIVING.

A practical manual for engineers in charge of stationary engines. By Michael Reynolds. Price, $2. For sale by Geo. H. Frost, 19 Tribune Building, New York City.

JENKINS PATENT VALVES

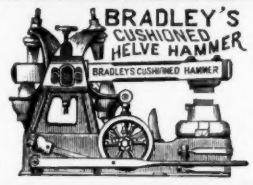
THE STANDARD MANUFACTURED OF BEST STEAM METAL.
JENKINS BROS. 71 JOHN ST. N.Y.

Grey Iron Castings

Of superior quality for machinery and other purposes. Delivered promptly in New York. Estimates given. Castings finished when required.

Sedgwick & Stuart Mfg. Co.
POUGHKEEPSIE, N. Y.

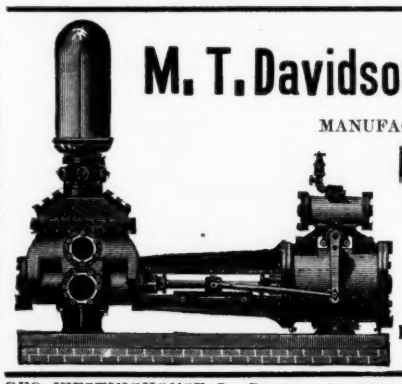
BRADLEY'S CUSHIONED HELVE HAMMER



STANDS TO-DAY Without an Equal.
OVER 700 IN USE.
Bradley & Co.
SYRACUSE, N. Y.

THE

M. T. Davidson Improved Steam Pump,



MANUFACTURED BY

Davidson Steam Pump Co.,

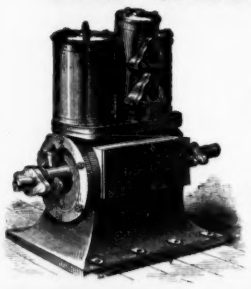
OFFICE & WORKS:
41 to 47 KEAP STREET, BROOKLYN, N. Y.

Warranted the Best Pump made for all Situations.

KELLY & LUDWIG, Agents, 49 and 51 North 7th St., Phila., 97 Liberty Street., New York.

GEO. WESTINGHOUSE, Jr., Pres't. RALPH BAGALEY, Sec. & Treas. H. H. WESTINGHOUSE, Sup't

THE WESTINGHOUSE MACHINE CO.



Will make Special Contracts with Manufacturers of High Speed Machinery to DRIVE DIRECT WITH

The Westinghouse Engine,

Without the Use of Belts.

Correspondence solicited. Send for Illustrated Circular to

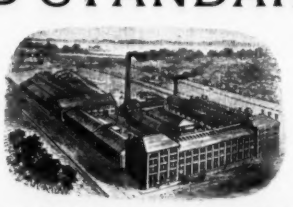
THE WESTINGHOUSE MACHINE CO.
92 and 94 Liberty Street,
Works at Pittsburgh, Pa. NEW YORK.

THE YALE LOCK MFG. CO.,

Manufacturers, Engineers and Machinists,
HENRY R. TOWNE, Pres't.
Manufacturers of the following Specialties:

YALE AND STANDARD LOCKS.

TIME LOCKS,
DIAL LOCKS,
PADLOCKS,
SAFE DEPOSIT AND PRISON LOCKS.



WESTON'S DIFFERENTIAL PULLEY BLOCKS, HOISTS, CRABS, and WINCHES.

JIB, PILLAR, TRAVELING AND SPECIAL CRANES.

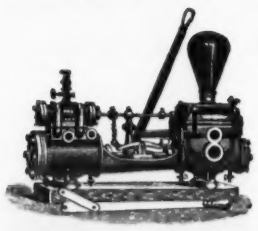
Principal Office and Works, STAMFORD, CONN.

SALESROOMS:

NEW YORK, 53 CHAMBERS ST. | BOSTON, 224 FRANKLIN ST. | PHILADELPHIA, 507 MARKET ST. | CHICAGO, 64 LAKE ST.

SPECIAL CATALOGUE FURNISHED ON APPLICATION.

Knowles' Improved Steam Pumps,



THE STANDARD!

Steam Pumps for Every Possible Service.

SEND FOR ILLUSTRATED CATALOGUE.

KNOWLES STEAM PUMP WORKS,

86 Liberty Street, NEW YORK. | *44 Washington Street,* BOSTON.

THE CAMERON STEAMPUMP.

Is the Standard of Excellence
AT HOME AND ABROAD.

THE A. S. CAMERON STEAM PUMP WORKS,
Foot of East 23d Street, New York.

"STANDARD" GAUGE.

Any Size from ¼ inch to 6 inch.

Class "B" guaranteed to 1-10000th of an inch.
" "C" " " 1-5000th " "

Betts Machine Co.

WILMINGTON, DEL.

Manufacturers of

MEASURING IMPLEMENTS.

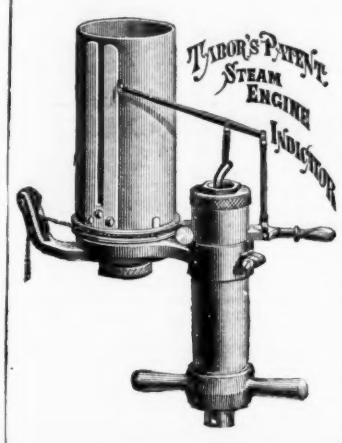
Standard Gauges,
Measuring Machines,
Adjustable Reamers.

NICHOLSON FILE CO.,
SOLE MANUFACTURERS OF
FILES AND RASPS
HAVING THE INCREMENT CUT.
Also, FILERS' TOOLS and SPECIALTIES,

"Nicholson File Co's" Files and Rasps.
"Double Ender" Saw Files. File Brushes, File Cards.
"Slim" Saw Files. Surface File Holders.
"Racer" Horse Rasps. Vise File Holders.
Handled Rifflers. Stub Files and Holders.
Machinists' Scrapers. Improved Butchers' Steels.

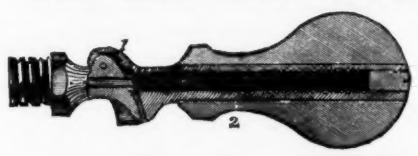
Manufactory and Offices at **PROVIDENCE, R. I., U. S. A.**

ESTABLISHED 1851.



The Ashcroft Manufacturing Co.
Successors to E. H. ASHCROFT,
"Original Steam Gauge Works."
THE E. H. ASHCROFT
Improved "Bourdon" Steam Gauges.
Sole Owners and Manufacturers of
TABOR'S PATENT
STEAM ENGINE INDICATORS,
Specially adapted to
Indicating High Speed Engines and Locomotives.
STEAM and WATER GAUGES,
Railway, Steamship and Machinery Supplies.
111 Liberty Street, New York.
Factories, BOSTON & LYNN.
E. L. MAXWELL, Prest. H. S. MANNING, Treas.
CHAS. A. MOORE, V-Prest. MARTIN LUSCOMB, Sec'y.

THE BEST BALL GAUGE COCK IN THE MARKET.



Each Gauge Cock has four inches of Jenkins' Packing. One packing will last several years.

A LARGE STOCK CONSTANTLY ON HAND.

E. G. FELTHOUSEN,
MANUFACTURER OF
HAND and AUTOMATIC CYLINDER OIL PUMPS, RATCHET DRILLS,
FLUE CLEANERS, &c., &c.
SALESROOMS, 59 AND 61 MAIN STREET,
FACTORY, 72 TO 80 WASHINGTON STREET, } BUFFALO, N. Y.

H. PRENTISS & COMPANY,
No. 42 Dey Street, New York.
P. O. BOX 3362.
DEALERS IN
MACHINISTS', MANUFACTURERS' AND RAILWAY
Tools & Supplies.

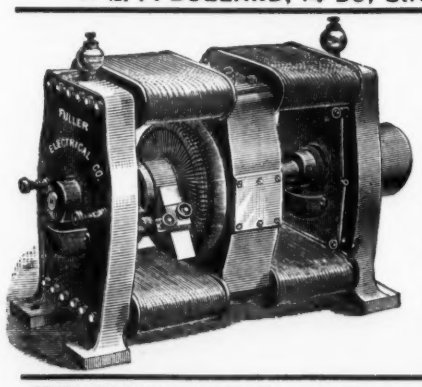
AKRON IRON COMPANY,
AKRON, O.

PATENT HOT POLISHED SHAFTING.

Superior to any shafting in market for the following reasons, viz.: 1st.—It is perfectly straight and round. 2d.—It can be rolled accurately to any desired gauge. 3d.—It has the beautiful blue finish of Russia Sheet Iron, rendering it less liable to rust or tarnish than shafting of the ordinary finish. 4th.—It will NOT SPRING or WARP IN KEY SEATING like most of the other manufactured shafting sold in the market, and, as a consequence, is admirably adapted for LINE AND COUNTER SHAFTING. 5th.—The surface is composed of MAGNETIC OXIDE OF IRON, forming a superior journal or bearing surface. 6th.—It is made of superior stock.

Sizes made from ¾ to 3¼ inches, advancing by sixteenths. Price lists, with references and other information, furnished on application to

AKRON IRON CO., Akron, O., Sole Manuf'rs,
Or **E. P. BULLARD, 14 Dey Street, New York,** General Eastern Agent.



ELECTRIC LIGHT!
THE FULLER ELECTRICAL COMPANY,
having perfected their system of Electric Lighting, are prepared to furnish the **Improved Gramme Dynamo Electric Machines and Electric Lamps,** either for single lights or for from **2** to **20** lights in one circuit.

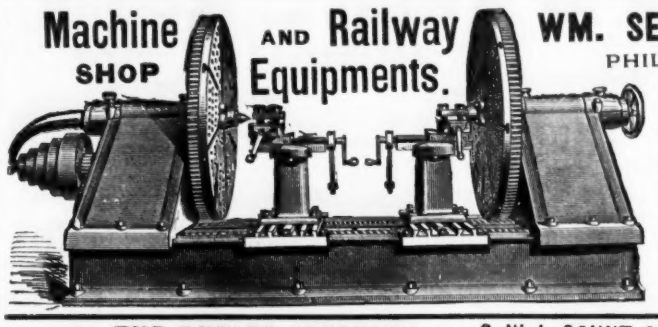
This apparatus is unexcelled for **durability, steadiness of light** and **economy of power,** and **requires less attention than any other.**

For price list and further particulars, apply to

THE FULLER ELECTRICAL COMPANY,
44 East Fourteenth Street, NEW YORK.

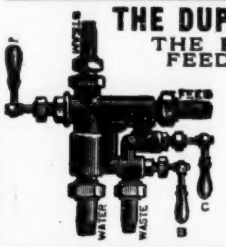
TEWKSBURY AUTOMATIC ELEVATOR CO.
MANUFACTURERS OF
PACKAGE AND LIGHT FREIGHT
ELEVATORS,
60 Temple Court, Beekman Street,
Send for Circulars. NEW YORK.

Machine SHOP AND Railway Equipments.



WM. SELLERS & CO.
PHILADELPHIA.
Shafts, Couplings, Hangers, Pulleys, Mill Gearing, etc., Lathes, Planers, Drills, Shapers, Bolt Cutters, Twedell's Hydraulic Riveters, etc. Railway Turntables and Pivot Bridges. Gifford Injectors, Sellers' Improvements. New Patterns. Simple. Effective.
New York Office,
79 LIBERTY ST.

THE DUPLEX INJECTOR.
THE BEST BOILER FEEDER KNOWN.



Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler. Will start when it is hot Will feed water through a heater. Manufactured and for sale by
JAMES JENKS,
Detroit, Mich.

DRAWING INSTRUMENTS
AND MATERIAL, PAPER, &C.
G. S. WOOLMAN,
116 Fulton Street, New York.
Fully priced and illustrated Catalogues.

WORCESTER MACHINE SCREW CO.

AND 111 LIBERTY ST NEW YORK
MANUFACTURERS OF
STANDARD MACHINE SCREWS.

C. W. LeCOUNT, South Norwalk, Conn.
LE COUNT'S HEAVY STEEL DOG.
With Steel Screws. Lathe Made and Hardened.

This Dog is very heavy, and is warranted not to break with any work.

When ordering, state as above, whether a full set, or a set of 12, or small set of 8. Users of these dogs prefer them to any other make.

No. 1	.3-8 in		$ .50
" 2	.1-2 "		.60
" 3	.5-8 "		.70
" 4	.3-4 "		.70
" 5	.7-8 "		.80
" 6	.1 "		.80
" 7	.1 1-8 "		.95
" 8	.1 1-4 "		.95
" 9	.1 3-8 "		1.10
" 10	.1 1-2 "		1.10
" 11	.1 3-4 "		1.25
" 12	.2 "		1.40
" 13	.2 1-4 "		1.60
" 14	.2 1-2 "		1.60
" 15	.3 "		1.80
" 16	.3 1-2 "		2.00
" 17	.4 "		2.30
" 18	.4 1-2 "		3.00
" 19	.5 "		3.50
Full set, 19 Dogs,			26.35
No 20	.5 1-2 in		4.25
" 21	.6 "		5.00

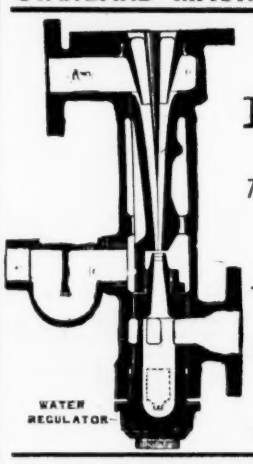
No. 1	.3-8 in		.50
" 2	.1-2 "		.60
" 4	.3-4 "		.70
" 6	.1 "		.80
" 8	.1 1-4 "		.95
" 10	.1 1-2 "		1.10
" 11	.1 3-4 "		1.25
" 12	.2 "		1.40

Small set of 8 Dogs from 3-8 to 2 inches, $7.30.

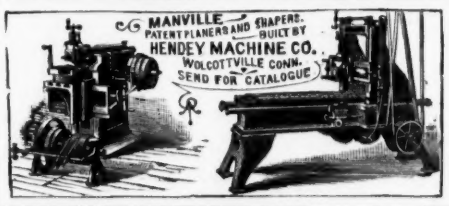
No. 14	.2 1-2 in		$1 60
" 15	.3 "		1.80
" 16	.3 1-2 "		2.00
" 17	.4 "		2.30

Set of 12 from 3-8 to 4 inches, $15.00.

ESTABLISHED 1850.

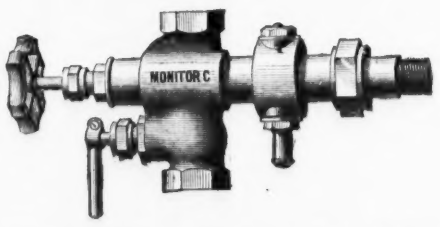


SCHAFFER & BUDENBERG,
NEW INJECTOR
Worked by Exhaust Steam Alone.
Takes the place of Feed Pump, Heater, and by Condensing the Exhaust Steam removes the Back Pressure.
UTILIZES A POWER HERETOFORE THROWN AWAY.
Works automatically at a steam pressure of less than half a pound. Adapted to all pressures.
For LOCOMOTIVES as well as STATIONARY ENGINES.
WORKS AT BUCKAU,—GERMANY.
DEPOT GENERAL OF THE UNITED STATES,
W. HEUERMANN, 40 JOHN STREET, NEW YORK.



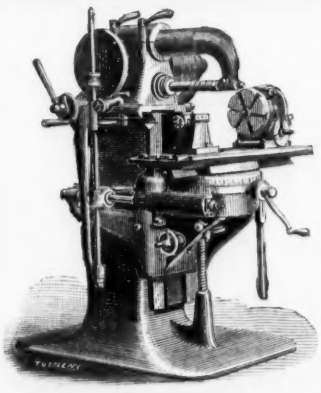
The Hendey Machine Co.
TORRINGTON, CONN., U. S. A.
Manville Patent Iron Planers and Shapers.
15 in. Shapers, 24 in. Shapers, 3½ ft. x 16 in., 5 ft. x 20 in., 6 ft. x 24 in., 8 ft. x 24 in. Planers, Amateurs' Hand Planers, with chuck and centers, Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck, and Common Clock Lathes. Catalogue gives many names of users of our tools.

THE "MONITOR."



A NEW LIFTING & NON-LIFTING INJECTOR.
BEST BOILER FEEDERS IN THE WORLD.

FRIEDMANN'S
Patent Ejectors,
OR
WATER ELEVATORS,
For Conveying Water and Liquids.
Pat. Oilers & Lubricators, &c.
NATHAN & DREYFUS,
Patentees and Manufacturers,
92 and 94 Liberty Street,
NEW YORK.
Send for Illustrated Catalogue.



New Heavy Universal Milling Machine.

Correspondence solicited.

MANUFACTURED BY
C. E. LIPE, Syracuse, N. Y.

Worthington PUMPING ENGINES

AND
STEAM PUMPS.

HENRY R. WORTHINGTON,
239 Broadway, New York.
70 Kilby St., Boston. | 707 Market St., St. Louis
Send for Latest Catalogue.

THE E. HORTON & SON CO.

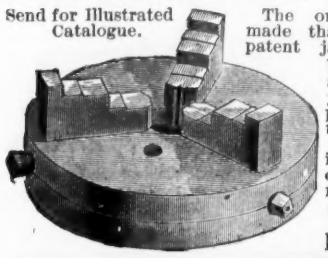
Canal St., Windsor Locks, Conn., U. S. A.

Only Manufacturers of the

HORTON Lathe and Car Wheel CHUCKS.

CAR WHEEL CHUCKS FROM 30 TO 42 INCH.

Send for Illustrated Catalogue.



The only chucks made that use the patent jaw, with both face and bite of jaws ground perfectly true.

None genuine without our trade-mark "The Horton Lathe Chuck."

T. NEW'S PREPARED ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 38 John Street, New York.

"THE SWEETLAND CHUCK."

WOOD-WORKING MACHINERY.

Universal Wood Workers, Planing, Matching, Moulding, Band and Scroll Sawing Machines, Carriage, Wagon and Wheel Machinery, etc.

BENTEL, MARCEDANT & CO.,
HAMILTON, OHIO, U. S. A.

THE GARDNER COMPENSATION GOVERNOR.

Unequaled for accuracy, safety, convenience, durability, workmanship, and design.

Address,
ROBERT W. GARDNER,
QUINCY, ILL.

New York Agents, JAMES BEGGS & CO., No. 9 Dey Street.

TESTIMONIAL

OF THE MERITS OF THE

HANCOCK INSPIRATOR.

PITTS AGRICULTURAL WORKS.
BUFFALO, N. Y., April 26, 1882.

THE HANCOCK INSPIRATOR CO.,
BOSTON, MASS.

Gentlemen:

At your solicitation we were induced to make experiments with the Hancock Inspirator on our Traction Engines, for the purpose of testing their reliability for use on the road, and being so well recommended by your agent, Mr. Randall, we, by his suggestion, made the following test, which was even more than we ever expect any engine will be called upon to perform, viz.:

Within a space of fifty feet were placed 6 x 4-inch timber, and alternately, twenty one pieces of pig iron, on hard ground, over which the engine was propelled four times, without interfering with the operation of the Inspirator; but it performed its duty the same as when the engine was at rest, thereby not only proving the strength of our engine, but also the faithful performance of the Inspirator, under the most adverse circumstances.

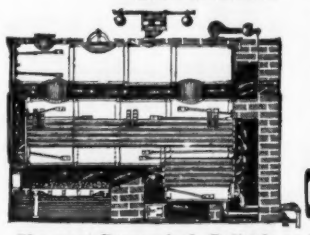
We therefore cheerfully recommend its use to all our patrons, and any who are in need of a reliable machine, under all circumstances, for a boiler feeder. We have also placed one on our shop boilers, giving good results and perfect satisfaction.

Yours truly,
LEVI BRONSON,
Superintendent.
ROBERT W. AITHEN,
Master Mechanic.

WM. T. BATE & SON,

CONSHOHOCKEN, PENNA.

Manufacturers of



BATE'S PATENT STEAM Generator.

The most Economical, Reliable and Durable.

A large number of these boilers in use in the best establishments and institutions, showing **Splendid Results** in the way of economy, efficiency, durability and convenience of cleaning. We refer to parties using. Write for particulars.

ROLLSTONE LATHE IMPROVEMENT ON THE WEYMOUTH LATHES, BAND SAWS,

Rotary and Stationary Bed Planers and Buzz Planers, Jig Saws, Variety Moulding Machines, Pattern Makers' Lathes, also a large stock of Second-hand Machinery of all descriptions.

ROLLSTONE MACHINE CO.
45 Water St., Fitchburg, Mass.

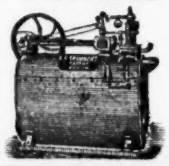
THE ALLIGATOR WRENCH,

Patented Aug. 31, 1875.

Teeth cut diagonally. Grips Round Iron or Pipe.

AMERICAN SAW CO.
TRENTON, N. J.

PORTABLE and STATIONARY ENGINES And BOILERS,



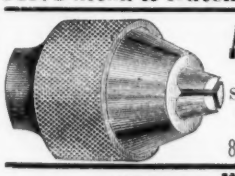
5 to 25 H. P. Parts duplicate and interchangeable, specially adapted to run Electric Light Machinery. Send for Circular.

SKINNER & WOOD, Erie, Pa.

Pattern and Brand Letters.

VANDERBURGH, WELLS & CO.

Cor. Fulton & Dutch Sts., New York.



Almond Drill Chuck.

Sold at all Machinists' Supply Stores.

T. R. ALMOND,
84 Pearl St., Brooklyn, N.Y

Holland & Thompson,

Troy, N. Y.

Manufacturers of the

HOLLAND LUBRICATOR

For lubricating the valves & cylinders of steam engines.

Operating with **downward visible drop.** The Principle of this Lubricator is entirely new; being the only one manufactured operating with a downward visible drop, and does not conflict with any other Patented Lubricator.

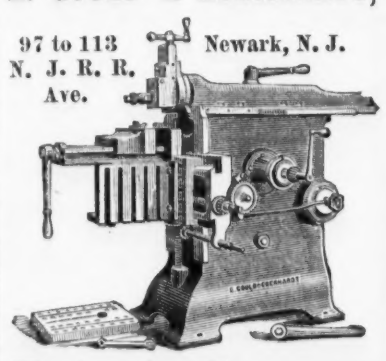
Protected with Letters Patent, granted July 5, 1881.

☞ A saving of from 50 to 90 per cent. in cost of oils.

For sale by
H. PRENTISS & CO.,
42 Dey St., New York.

E. GOULD & EBERHARDT,

97 to 113 N. J. R. R. Ave. Newark, N. J.

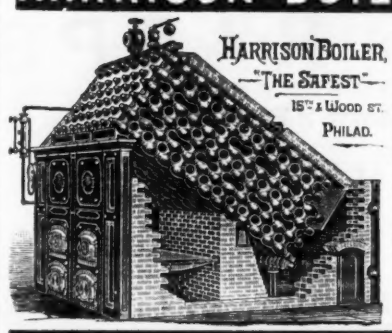


Patent Shapers,

QUICK Adjustable Stroke.
Can be CHANGED while in MOTION.

HARRISON BOILER. "THE SAFEST"

Adapted for all Steam Purposes.

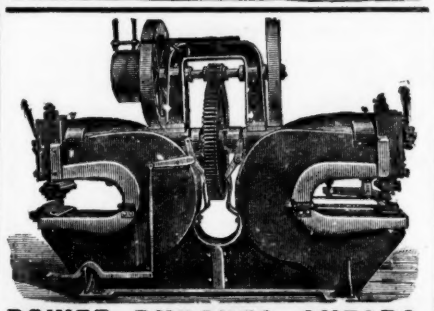


Merits have been proved during **ten to fifteen years constant use** by such concerns as Cheney Bros., South Manchester, Conn.; Wallace & Sons, Ansonia, Conn.; Wampanoag Mills, Weetamoe Mills, Sagamore Mills, Fall River, Mass.; Sears' Building, Boston, Mass.; Brown & Sharpe Mfg. Co., Providence, R. I.; A. T. Stewart & Co., Tiffany & Co., New York; Stevens' Institute, Hoboken, N. J.; Matthiessen & Wiechers Sugar Refinery, Jersey City, N. J.; Wm. Sellers & Co., S. S. White, Daniel Allen, Jno. Gardiner & Co., Phosphor-Bronze Smelting Co., Henry Bower, Evening Bulletin, Saturday Night, Philadelphia, Pa., and numerous others.

Franklin Institute Medal awarded for SUPERIORITY OF EVAPORATIVE EFFICIENCY, ECONOMICAL CAPACITY FOR GENERATING STEAM AND DYNAMIC VALUE OF STEAM. Easily transported on mule back. Send for Descriptive Catalogue.

HARRISON BOILER WORKS
15th and WOOD STS., PHILADELPHIA, Pa.

UPRIGHT DRILL PRESS $75.00
KEY SEATING MACHINE $55.00
SEND FOR CATALOGUE TO
W. P. DAVIS
NORTH BLOOMFIELD, ONT. CO. N.Y.



POWER PUNCHES, SHEARS HAMMERS.

We make over 100 sizes of Punches and Shears Double and Single, varying from 500 to 36,000 pounds in weight, and adapted for every variety of work The Double machines are equal to two Single ones as each side is worked independently. Also

ADJUSTABLE HELVE CUSHIONED HAMMERS

Of all sizes, unequalled for efficiency and durability

The Long & Allstatter Co.,
HAMILTON, OHIO.

The Inventors' Institute,

COOPER UNION,

3d & 4th Avenues, 7th & 8th Sts., New York City.

Recently enlarged, the Inventors' Institute now embraces, in addition to the suite of rooms occupied by its PATENT LAW DEPARTMENT, the INDUSTRIAL NEWS, and the officers of the Institute, 9 large halls with full front and entrances both on 3d and 4th avenues as well as on 7th and 8th streets. The whole is open free to the public.

Attention is invited to the advantages afforded for the exhibition under the most favorable auspices of improved machines, appliances and processes in all lines of industry and especially of new inventions. Ample power is furnished; proper care is taken of all exhibits. To NON-RESIDENT EXHIBITORS the advantages of an established agency in New York are afforded at moderate cost.

For full particulars address
THE INVENTORS' INSTITUTE

THE

Slate Sensitive Drill.

Adapted to rapid work with small drills. Its extreme sensitiveness prevents clogging and breakage of drills. Has a swinging table with attachment for center drilling. Instantly adjustable to different lengths of work. Over 200 already in use. Send for circular

DWIGHT SLATE,
HARTFORD, CONN

P. BLAISDELL & CO.
Manufacturers of
Machinists' Tools,
WORCESTER, MASS.

ALLEN'S HIGH SPEED AIR COMPRESSORS.

Allen Engines, Stationary and Marine Boilers, Hoisting Machinery, Patent Evaporators and Condensers.

JOHN McLAREN,
RIVER STREET, HOBOKEN, N. J.

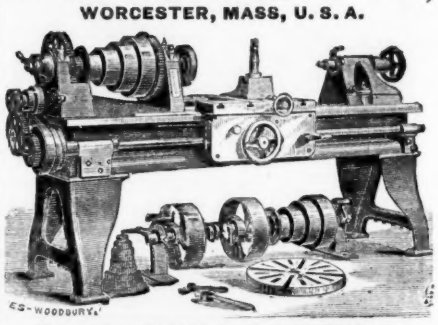
MACHINERY FOR REDUCING AND POINTING WIRE

by compression or swaging **COLD.** Machines manufactured under patents owned by Miller, Metcalf & Parkin, Pittsburgh, Pa. For machines or information, address

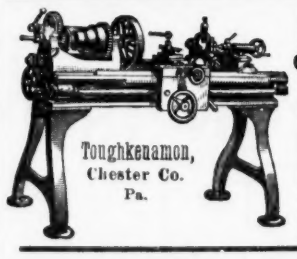
S. W. GOODYEAR,
WATERBURY, CONN.

A. M. POWELL & CO.,

WORCESTER, MASS, U. S. A.

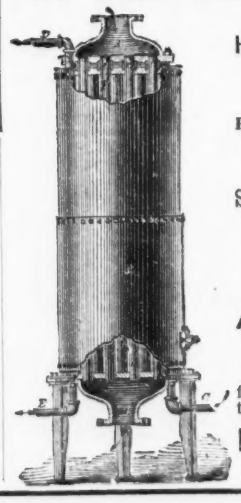


IRON WORKING MACHINERY.



S. ASHTON HAND,
MAKER OF
FIRST-CLASS
Engine Lathes

THE LOWE PATENT
Feed Water Heater & Purifier,



FOR
Heating and Purifying Water for Steam Boilers.

Patented July 12, 1877.

HAS STRAIGHT TUBES.

SIMPLICITY,
RELIABILITY
AND
EFFICIENCY,
At Less Cost
Than any other.

Write for prices and further information to the manufacturers,

Lowe & Watson,
BRIDGEPORT, CONN.

SCHUTTE & GOEHRING, Manufacturers of

KORTING'S DOUBLE TUBE INJECTOR.

OVER 30,000 IN USE.

THE LEADING BOILER FEEDER.

OPERATED BY ONE HANDLE.

WORKING UNDER ALL CONDITIONS.

WILL LIFT HOT WATER. POSITIVE IN ITS ACTION.

SEND FOR CIRCULAR.

OFFICES AND WAREROOMS:

12th and Thompson Sts., Philadelphia.
A. F. UPTON, 7 Oliver St., Boston.
POND ENGINEERING CO., 709 Market St., St. Louis
C. E. KENNEDY, 194 15th St., Denver, Col.
G. B. LOMBARD & CO., 1026 Fenwick St., Augusta, Ga.
A. ALLER, 109 Liberty St., New York.
M. C. BULLOCK MFG. CO., 84 Market St., Chicago.
GEORGE A. SMITH, 1419 Main St., Richmond, Va.
H. P. GREGORY & CO., 2 California St., San Fran'co.

A FIRE-PROOF NON-CONDUCTOR OF HEAT AND SOUND.

Made from Slag of blast furnaces. Encases about 90% of its volume of air. Heaviest grade about 25 lbs. per cu. ft.

MINERAL WOOL

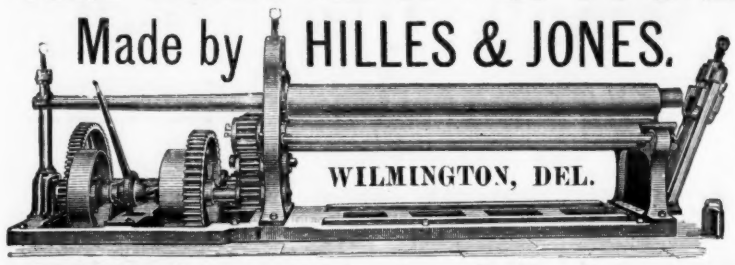
U. S. Mineral Wool Co.

16 CORTLANDT STREET, NEW YORK.

Price, 1 Cent Per Lb.

PATENT PLATE BENDING ROLLS

Made by HILLES & JONES.



THE CUT REPRESENTS ALL SIZES THAT ARE DRIVEN BY BELTS.

It is but the work of a moment to balance the top roll and lower the hinge housing to take out the plate when a full circle is bent. The rolls are all made of solid wrought iron, the balance bar being a part or extension of the top roll. There is a cast iron bed-plate under the entire machine. To save any shifting of belts we put in Friction Pulleys, which enable the rolls to be started, stopped or reversed instantly.

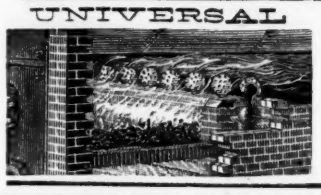
JOSEPH B. MATTHEWS, 41 Center Market Space, Baltimore, Md.

Manufacturer of the MATTHEWS

AUTOMATIC HIGH-SPEED ENGINE,

For Electric Lights and other purposes requiring steady, reliable power. The best and cheapest in the market. 25 H. P. for $500. Send for Circular.

UNIVERSAL



PATENT FURNACE,

SAVES FUEL AND INCREASES BOILER CAPACITY.

CORRUGATED GRATE BARS,

Suitable for Furnace Coal, Screenings, and all kinds of Waste Fuel.

JAMES MAHONY, 73 Astor House, New York.

BULKLEY CONDENSER,

For every class of Steam Engines, Steam Pumps, Vacuum Pans, &c.

Guaranteed to Save 20 to 25 per cent. of fuel, or gain 25 to 30 per cent. in power.

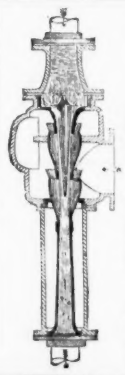
Send for pamphlets, prices, references, &c.

HENRY W. BULKLEY,

149 BROADWAY, N. Y.

SCHUTTE & COEHRING, Manuf's of

KORTING CONDENSER.



For Steam Engines and Pumps.

Requires no Air Pump and no foundations. Only 15 ft. height of water required from level of water supply to discharge pipe, instead of 34 ft., whether above or below engine cylinder. Has fewer parts, and is lower in price than any other condenser. Send for circular giving full information.

Offices and Warerooms:

12th & Thompson Sts., Philadelp'a.

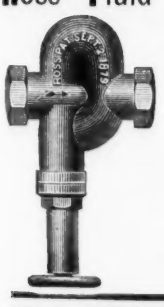
A. Aller, 109 Liberty St., New York.

FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS,

JAS. HUNTER & SON, North Adams, Mass.

CELEBRATED WOOD WORKING MACHINERY, IRON TOOLS, ENGINES & SUPPLIES. H. B. SMITH MACHINE CO. CORRESPOND WITH US. 925 MARKET ST. PHILADELPHIA, PA. U.S.A. AVAIL YOURSELF OF OUR LARGE STOCK.

Ross Fluid Pressure Reducer,



FOR

Steam, Water, Air and Gas.

Automatically reduces the pressure in pipes to any desired extent.

Manufactured by the

Ross Valve Co.

652 RIVER ST., TROY, N. Y.

Simplest! Cheapest! Best!

Send for Circular.

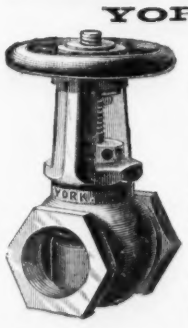
W. C. YOUNG & CO., Worcester, Mass.

Manufacturers of

ENGINE LATHES, HAND LATHES, Foot Power Lathes, Slide Rests, &c.

DIAMOND BRASS WORKS,

YORK, Pa.



Manufacturers of the

YORK GLOBE VALVE.

These Valves, 1 inch and over, have *outside* screws, insuring great durability. Can be reground without other tools than wrench and screw driver. Can be repacked with steam on either side of valve. All Valves packed and proved before shipping. Price as low as the ordinary globe valve.

Self-Oiling Hangers

Manf. by Chas. C. Klein, Marshall and Cambria Sts., PHILADELPHIA.

These bearings have been used over 12 months without requiring attention or replenishing of oil. The cheapest kind of oil, while it remains fluid, answers as well as the most expensive. No tools required to attend to the self-oiling part.

Also Shafting, Friction Pulleys, Improved Couplings, &c.

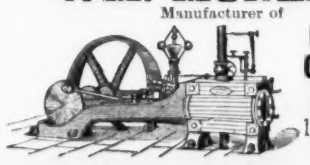
THOMAS D. STETSON,

PATENT SOLICITOR & EXPERT,

No. 23 Murray St., New York.

WM. MÜNZER,

Manufacturer of



IMPROVED CORLISS ENGINE.

1st Av. cor. 30th St. New York.

TOOLS

R. W. REXFORD

TOOL STORE 116 6TH ST. PHILA.

TOOLS FOR MACHINISTS, CARPENTERS, MODEL MAKERS, JEWELLERS, MOULDERS, BLACKSMITHS, AMATEURS &C

CATALOGUE FREE

DEAN BROS' STEAM PUMP WORKS,

INDIANAPOLIS, IND.

Boiler Feeders, Fire Pumps, Pumping Machinery for all purposes.

Send for Catalog

CLEM & MORSE,

413 Cherry Street, Philadelphia.

108 Liberty Street, New York.

Passenger and Freight Elevators,

WITH MOST APPROVED SAFETY DEVICES.

Represented in Boston by C. E. KIMBALL.
New Orleans, La. by HUGH W. MONTGOMERY.
St. Paul, Minn., by ROBINSON & CARY.
Ogden, Utah, by D. D. JONES.

PECK'S PAT. DROP PRESS.

BLAST FORGES.

STEEL & IRON DROP FORGINGS.

Drop Dies and Special Machinery.

BEECHER & PECK, NEW HAVEN CONN.

Fox Lathes,

Turret Head Lathes,

AND

SWIVEL HEAD ENGINE LATHES,

GEORGE GAGE, WATERFORD, N.Y.

THE REID DRILL CHUCK

The Strongest, most Simple and greatest Capacity of any in the market. Sold by all first-class Machinists' Supply Stores. Manufactured by

CHAS. H. REID,

DANBURY, CONN.

---

20 INCH SWING ENGINE LATHES.

F. C. & A. E. ROWLAND, New Haven, Conn.

POND ENGINEERING COMPANY,

ENGINEERS AND CONTRACTORS OF

Steam and Hydraulic Machinery,

709 Market St., St. Louis, Mo.

130 W. Second St., Cincinnati, O.

SEND FOR CIRCULAR.

CROSBY'S STEAM ENGINE INDICATOR.

CROSBY STEAM GAGE & VALVE CO.

J. H. MILLETT, Pres't. GEO. H. EAGER, Treas.
GEO. H. CROSBY, Sup't. WALTER P. CLARK, Sec'y.

Sole Proprietors and Manufacturers of CROSBY'S

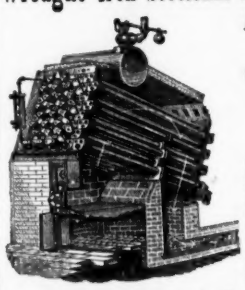
Adjustable "Pop" Safety Valve,
Improved Steam Pressure Gage,
Self-Closing Water Gage,
Improved Steam Engine Indicator.

Sole Manufacturers and General Agents for The "VICTORY" Steam Cylinder Lubricator, "Single Bell Chime Whistle," "Bay State Steam Muffler," and all instruments for use on Steam Engines, Boilers, &c., send for particulars.

97 OLIVER ST., BOSTON, MASS.

ROOT'S

Wrought Iron Sectional Safety Steam Boiler



ABSOLUTELY SAFE FROM EXPLOSIONS.

Unequaled in Economy of Fuel and Rapid Generation of Dry Steam.

All parts interchangeable. Easily erected in places inaccessible to other boilers. Altered or enlarged by any ordinary machinist. Shipped in packages weighing under 150 lbs. each. Low in price and first-class in material and workmanship

Over 260,000 H. P. in Use for all purposes.

Catalogues and Conclusive References mailed to any address. Drawings and full instructions for erection furnished with each boiler, making errors impossible.

ABENDROTH & ROOT MFG. CO. 28 CLIFF ST. NEW YORK.

AGENTS:

M. C. BULLOCK, 80 Market St., Chicago, Ill.
ALEX. E. BROWN, 130 Water St., Cleveland, Ohio.
GEO. J. ROBERTS & CO., Dayton, Ohio.

THOS. DANIEL, PATTERN MAKER 60 FULTON ST., NEW YORK.

Electrical and Intricate Core Work a Specialty.

JONES' PATENT FIRE-JAMB PLATES & BOILER SETTING.

Furnish permanent and perfect protection to the boiler front and supply heated air at the bridge wall to aid in combustion of gases.

Ask your Boiler Maker for it.

Manufactured by

Cohoes Iron Foundry and Machine Co.

COHOES, N. Y.

KENSINGTON ENGINE WORKS, (Limited,)

Vienna and Beach Sts., - - - PHILADELPHIA.

ENGINEERS AND MACHINISTS,

Manufacturers of

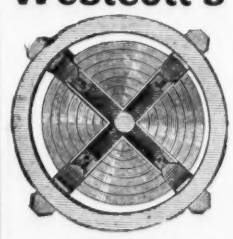
BUCKEYE AUTOMATIC ENGINES

For Middle and South Atlantic States.

SPECIAL MACHINERY BUILT TO ORDER.

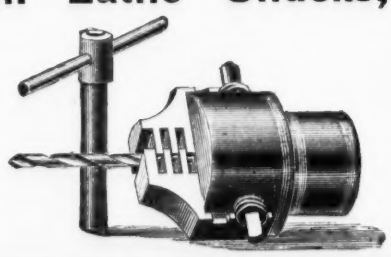
H. C. FRANCIS, Manager. JOHN T. BOYD, Engineer. WM. L. SIMPSON, Supt.

Westcott's Combination Lathe Chucks,



Both Scroll and Geared.

Greater capacity. Jaws reversible. No projecting screws in the rim. Movements independent, universal and eccentric.



Oneida Steam Engine and Foundry Co.

Send for circulars. ONEIDA, N. Y.

THE HARTFORD AUTOMATIC CUT-OFF ENGINE.

Built for Heavy and Continuous Work, and adapted to any required speed

Close regulation and best attainable Economy of Fuel. Circular and Practical Treatise on Steam Engineering sent on application.

The Hartford Engineering Company,

HARTFORD, CONN.

New York Office, Rooms 72 and 73 Astor House.

Hill, Clarke & Co., Agents, 36 Oliver St., Boston.

MORSE TWIST DRILL & MACHINE COMPANY,

NEW BEDFORD, MASS.

Sole Manufacturers of

MORSE PATENT STRAIGHT-LIP INCREASE TWIST DRILL,

SOLID AND SHELL REAMERS, BEACH'S PATENT SELF-CENTERING CHUCK, BIT STOCK DRILLS.

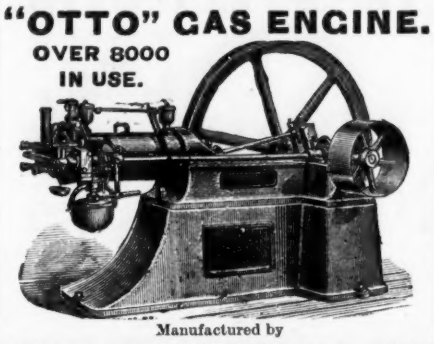
Drills for Coes, Worcester, Hunter and other Hand Drill Presses. Drill Grinding Machines, Center and Adjustable Drill Chucks, Taper Reamers, Milling Cutters, and Special Tools to order.

All Tools Exact to Whitworth Standard Gauges.

GEO. R. STETSON, Sup't. EDWARD S. TABER Pres't and Treas

"OTTO" GAS ENGINE.

OVER 8000 IN USE.



Manufactured by

SCHLEICHER, SCHUMM & CO., 33d & Walnut Sts., Philada.

IMPROVED CRANK PLANER,

MADE BY

R. A. BELDEN & CO.

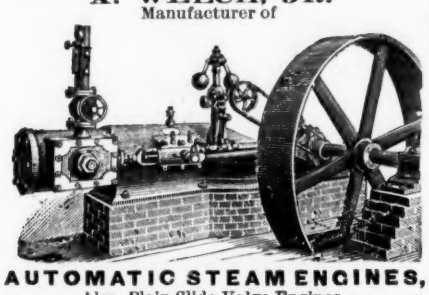
DANBURY, CONN.

A valuable tool for Die Work and other planing requiring a short and rapid or variable stroke. Planes 16 in. high and wide, and has 12 in. stroke, with quick return motion. Has steel screws, wrought handles, and cut gears and pinions. Power feed in all directions.

LAMBERTVILLE IRON WORKS,

A. WELCH, JR.

Manufacturer of



AUTOMATIC STEAM ENGINES,

Also, Plain Slide Valve Engines.

Send for Circular. LAMBERTVILLE, NEW JERSEY.

F. W. MOSS,

80 JOHN ST., N. Y.

STEEL AND FILES,

HAMMERS.

Warranted Cast Steel, for Dies, Punches, Drills, Turning Tools, Taps, Reamers, &c.

IMP'D MILD-CENTRED CAST STEEL

For Taps, Reamers, &c.

FRANK THOMPSON,

Monitor, Hand, Speed and Back Geared

LATHES.

Slide Rests, Chucks and Brass Finishers Tools of the finest quality.

168 CENTRE STREET, N. Y. CITY.

THE MACKENZIE CUPOLA

MADE BY

Smith & Sayre Mfg. Co.

245 BROADWAY,

NEW YORK,

Differs from all others in having a continuous tuyere. Blast enters fuel at all points, causing complete diffusion of air, and uniform temperature throughout the furnace. Melts 10 to 15 tons an hour with blast pressure required to melt 2 or 3 tons in an ordinary cupola. Gains largely in time, fuel and quality of casting.

JOHN H. WRIGHT, BRIDGEPORT, Conn.

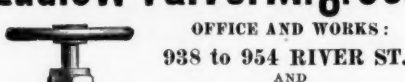
MANUFACTURER OF

Lathes and Planers,

FROM THE LATE WOOD, LIGHT & CO.'S PATTERNS,

Having formerly been a contractor in building the same, will give first-class work to all who favor me with their orders.

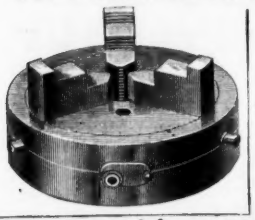
CRITCHLEY'S PATENT EXPANDING REAMER.



Manufactured by CRITCHLEY & WHALLEY,

Send for Circular. PORTSMOUTH, N. H.

"THE NATIONAL CHUCK"



WARRANTED SUPERIOR TO ANY CHUCK IN THE MARKET

NATIONAL M'F'G CO. NEW HAVEN, CONN

H. BICKFORD,

Manufacturer of

Drills

AN EXCLUSIVE SPECIALTY.

N. W. Corner Pike and Front Sts.

CINCINNATI, O.

Ludlow Valve Mfg. Co.

OFFICE AND WORKS:

938 to 954 RIVER ST., AND 67 to 83 VAIL AVE.

TROY, N. Y

VALVES—Double and Single Gate, ¼ in. to 48 in. outside and inside Screws, Indicator, etc., for Gas, Water and Steam.

Also,

FIRE HYDRANTS.

SEND FOR CIRCULAR.

J. A. FAY & CO., CINCINNATI, Ohio, U. S. A.

BUILDERS OF IMPROVED

Wood-Working Machinery.

Embracing nearly 400 Machines for

Planing & Matching,

Surfacing, Moulding, Tenoning, Mortising, Boring, and Shaping, &c.

Variety and Universal

WOOD WORKERS.

Band, Scroll and Circular Saws, Resawing Machines, Spoke and Wheel Machinery, Shafting, Pulleys, etc. All of the highest standard of excellence.

W. H. DOANE, Pres't. D. L. LYON, Sec'y.

TOOLS.

Machinists, Engineers, Model Makers and all classes of Mechanics can find TOOLS to suit them at

184 to 188 WASHINGTON STREET, BOSTON, MASS.

A. J. WILKINSON & CO.

CATALOGUES FREE.

Buffalo Cupola & Forge Blowers.

Warranted superior to any other make.

All sizes and styles for every class of work.

BUFFALO FORGE CO.

BUFFALO, N.Y.

Send for Catalogue and prices.

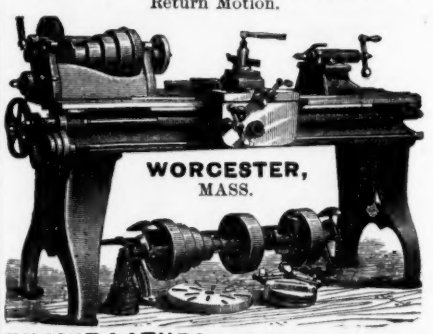
F. E. REED,

Successor to A. F. PRENTICE & CO.,

Manufacturer of

MACHINISTS' TOOLS.

IMPROVED UPRIGHT DRILLS, with Lever Feed, and Wheel Feed with Quick Return Motion.



WORCESTER, MASS.

ENGINE LATHES, HAND LATHES, SLIDE RESTS, and PLANER CENTERS.

WHITCOMB MF'G CO.

Formerly C. Whitcomb & Co.

Manufacturers of

Machinists' Tools,

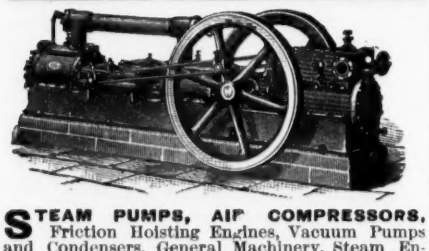
WORCESTER, MASS.

IRON PLANERS A Specialty.

HAND & POWER SHAPING MACHINES. Full length of stroke 6 in. May be adjusted to any less distance desired. Automatic cross feed, with 6 in. traverse. Vertical adjustment of table, 5 inches.

For full particulars apply to

BOYNTON & PLUMMER, Worcester, Mass.



STEAM PUMPS, AIR COMPRESSORS, Friction Hoisting Engines, Vacuum Pumps and Condensers, General Machinery, Steam Engines. Capacity to bore cylinders 110 in. diameter and turn Fly Wheels of 24 feet.

The Norwalk Iron Works Co.

SOUTH NORWALK, CONN.

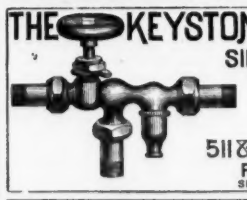
New Haven Manf'g Co.

NEW HAVEN, CONN.

Iron-Working Machinery,

PLANERS, SHAPERS, DRILLS.

THE KEYSTONE INJECTOR



SIMPLEST & BEST, BOILER FEEDER

MANF'CD BY

E. TRACY

511 & 513 N. 12TH ST,

PHILADELPHIA PA.

SEND FOR CIRCULAR.

SHAPING MACHINE.

Hewes & Phillips' Iron Works,

NEWARK, N. J.

Manufacturers of the New

Patent High Speed Allen Engine,

PLANERS, LATHES, SHAPERS, SLOTTERS, DRILL PRESSES,

Both double and single column, Bolt and Pipe Cutters, Keyseating Machines, Hydraulic and Sugar Estate Machinery, Shafting and Gearing, Boilers, &c. Heavy Hydraulic Oil Presses a specialty.

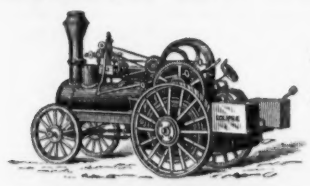
One 48" x 48" x 12 ft. Planer in stock.

ARMSTRONG'S IMPROVED ADJUSTABLE STOCK AND DIES FOR PIPE AND BOLTS.

Tapped to the U. S. and Whitworth Standard Gauges. *Adjustable* to all variations in the size of fittings. Can be *resharpened without drawing the temper* by simply grinding them. Possessing practical advantages appreciated by all mechanics. Circulars sent free on application.

Manufactured by F. ARMSTRONG, Bridgeport, Conn.

ECLIPSE PORTABLE & TRACTION ENGINES



Stationary Engines.

Iron and Steel Boilers.

Portable Circular Saw Mills.

Threshers & Separators.

Send for Catalogue and say where you saw this.

FRICK & CO.

Waynesboro, Franklin Co., Pa.

WE CHALLENGE THE WORLD FOR ITS EQUAL

RUFFNER & DUNN,

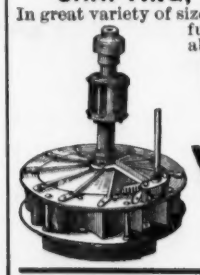
Schuylkill Falls, Philadelphia.

Patentees and Sole Manufacturers of the Excelsior Steel Tube Cleaners. $1.00 per inch. Most liberal discounts to dealers. Send for circular.

MACHINE MOULDED MILL GEARING,

SHAFTING, PULLEYS, ETC.,

In great variety of sizes. Castings or finished work furnished the Trade at favorable rates.

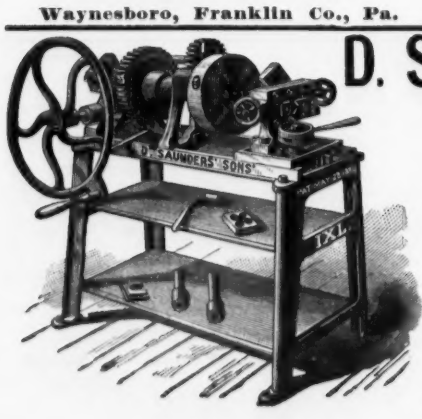


LEFFEL TURBINE WATER WHEELS,

MANUFACTURED BY

POOLE & HUNT,

Baltimore, Md.



D. SAUNDERS' SONS,

MANUFACTURERS OF THE ORIGINAL

TRADE I.X.L. MARK

Pipe Cutting & Threading Machine,

BEWARE OF IMITATIONS.

None Genuine without our Trade-Mark and Name.

STEAM AND GAS FITTERS' HAND TOOLS,

Pipe Cutting and Threading Machines,

For Pipe Mill use a Specialty.

Send for Circulars. YONKERS, N. Y.

PAINE & LADD,

HALBERT E. PAINE, Late Comm'r Patents.

STORY B. LADD.

WASHINGTON, D. C.

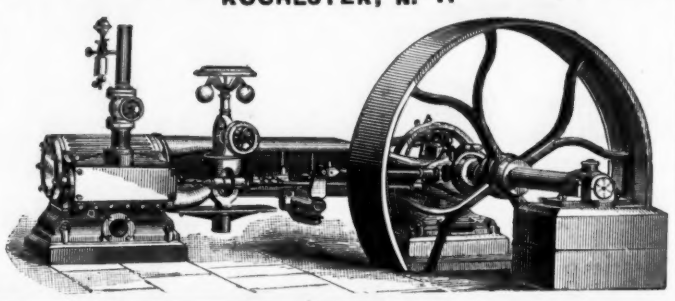
Solicitors of Patents and Attorneys in Patent Cases.

WOODBURY, BOOTH & PRYOR.

Manufacturers of

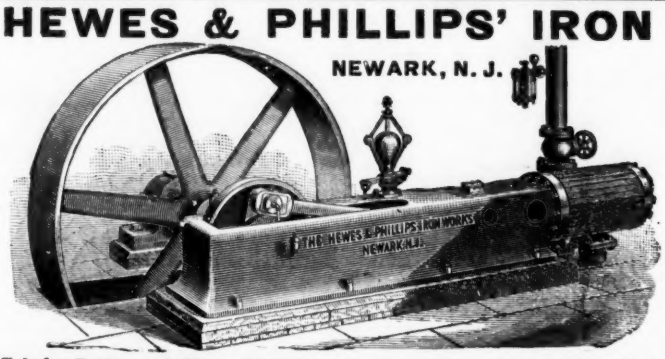
ROCHESTER, N. Y.

Automatic Cut-Off,
Fixed Cut-Off,
and Slide Valve
STEAM
ENGINES,
Tubular Boilers.



HEWES & PHILLIPS' IRON WORKS,

NEWARK, N. J.



Manufacturers of

The ALLEN PATENT HIGH-SPEED ENGINE.

Both Condensing and Non-Condensing, especially designed and constructed for the Rolling and Cotton Mill Trade, and all establishments requiring an absolutely uniform and economical power.

Tubular Boilers and Steam Fittings. Contracts taken for complete Motive Power Outfits.

KELLY & LUDWIG, 49 & 51 N. SEVENTH ST. PHILADELPHIA, Pa.

NEW IRON WORKING MACHINERY On Hand or for Quick Delivery.

Write for prices and particulars.

ENGINE LATHES.

38 inch, triple-geared (bed to suit).			Fitchburg.
28 inch swing,		18 foot bed.	Fitchburg.
26 "	"	18 "	Fitchburg.
24 "	"	14 and 16 "	Fitchburg.
21 "	"	12 and 14 "	Blaisdell.
20 "	"	14 "	Fitchburg.
20 "	"	12 "	Fifield.
19 "	"	10 and 12 "	Gray.
18 "	"	10 and 12 "	Blaisdell.
17 "	"	6 "	Johnson.
16 "	"	6 and 8 "	Fitchburg.
14 "	"	6 and 8 "	Fitchburg.
13 "	"	8 "	Blaisdell.

PLANERS AND SHAPERS.

30 inch x 30 inch x 8 foot,	Fitchburg.
25 inch x 25 inch x 8 foot,	Fitchburg.
30 inch x 30 inch x 10 foot,	Hewes & Phillips
36 inch x 36 inch x 9 ft., planer.	2d hand, good order. Wheeler.
26 inch x 24 inch x 6 and 7 ft. planer,	Wheeler.
22 inch x 20 inch x 4 ft. planer,	Wheeler.
10 inch stroke shaper,	Fitchburg.
15 inch stroke crank planer,	Blaisdell.
10 inch stroke shaper,	Gould.
15 inch stroke shaper,	Gould & Eberhardt.

DRILL PRESSES.

60 inch radial drill, double-geared, self-feed, planed and slotted bed-plate with portable table. Best English make. Weight 4 tons.

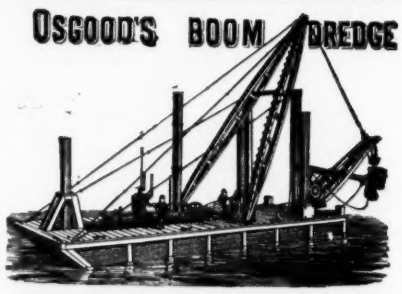
48 inch radial drill, self-feed, double gearing slotted and planed bed. Betts.

30 inch, back-geared, automatic.	Prentice.
25 inch, back-geared, self-feed,	Fitchburg.
25 inch, quick return.	Blaisdell.
19 inch, " "	Blaisdell.
18 inch, " "	Blaisdell & Fitchburg.
2, 3, and 4 spindle drills,	Garvin.
15 inch swing, 5 foot bed, Fox Lathe,	Gage.
No. 2 (⅜-1¼) Bolt Cuttters,	Merrimans.
Power and Hand Millers,	Garvin.
12 inch slotter (swing 56 inch),	Hewes & Phillips.

MECHANICAL DRAWINGS.

Copies or Tracings of any class of machinery made and used in Europe. 2000 designs. **WOOD & RICHMOND,** Mechanical Engineers and Draughtsmen, 176 Broadway, N. Y.

OSGOOD'S BOOM DREDGE



Guaranteed to excavate 50% more material from hard bottom than any other machine. Circulars, comparative strain sheets, &c., furnished.

OSGOOD & MACNAUGHTON, Albany, N. Y., successors to **Ralph R. Osgood, Troy, N. Y.**

SEND FOR LIST OF

IRON WORKING MACHINERY

ON HAND.

NEW AND SECOND-HAND.

SPECIALTIES.

Extra Heavy Bridgeport 16 in. Swing Engine Lathes.

SECOR SCREW MACHINES.

WRITE FOR WHAT YOU WANT.

E. P. BULLARD,

14 DEY STREET, NEW YORK.

NEW & SECOND-HAND MACHINERY.
AUG. 1, 1882.

1	Engine Lathe,	14 in. x 6 ft.	Grant & Bogert. New.
1	" "	42 in. x 14 ft.	New.
1	" "	36 in. x 12, 17 and 25 ft.	New.
1	" "	21 in. x 6 ft.	In good order. Pond.
1	" "	18 in. x 8 ft.	" " "
1	" "	14 in. x 6 ft.	Star Tool Co. New.
2	" "	15 in. x 6 ft.	"
1	" "	14 in. x 5 x 6 ft.	"
1	" "	16 in. x 6, 7 & 8 ft.	Bridgeport. "
1	" "	13 in. x 5 ft. & 6 ft.	Ames. "
1	" "	16 in. x6, 7 & 8 ft.	Ames. "
1	" "	18 in. x8 & 10 ft.	Lodge & Barker "
1	" "	24 in. x 12 ft.	Perkins. "
1	" "	24 in. x 16 ft.	" "
1	" "	30 in. x 16 ft.	" "
1	" "	22 in. x 10 ft.	Fifield. New.
1	" "	11 in. x 4 ft. & 5 ft.	Prentiss.
1	" "	11 in. x 4 ft.	New.
1	" "	12 in. x 5 ft.	Young. New.
1	Plain Engine Lathe, 16 in. x 4 ft.		"
1	Engine Lathe, 15 in. x 4 ft.		Plain. New.
1	Fox Lathe, 15 in. x 5 ft.		Pike & Dean. "
1	15 in. x 4 ft.		Turret Lathe. Lodge & Barker.
1	Planer, 28 in. x 28 in. x 6 ft.		A1 order.
1	" 36 in. x 36 in. x 10 ft.		Good order. Wheeler
1	" 16 in. x 16 in. x 3 ft.		new
1	" 24 in. x 24 in. x 6 ft.		Hendey. "
1	" 26 in. x 26 in. x 7 ft.		"
1	Upright Drill, 16 in.		Prentiss. "
1	20 in. Upright Drill.		" "
1	23 in. "		B. G. S. F. Thompson. New.
1	24 in. "		Prentiss. New.
1	30 in. "		" "
1	15 in. Shaper.		Gould & Eberhart. "
1	15 in. Shaper.		Hendey. "
1	Pratt & Whitney No. 2 Screw Machine.		Fair order.
	Garvin Millers Spindle Drills, &c. New.		
1	Universal Tool Grinder.		D. Slate. New.
1	Schlenker Bolt Cutter to take sizes from ¼ to 1¼ inches inclusive. New.		
1	Milling Machine.		New.
1	Nut Tapper, 7 Spindles.		New. Durrill.
1	Hand Lathe, 12 x 4, 5 and 6 ft.		New.

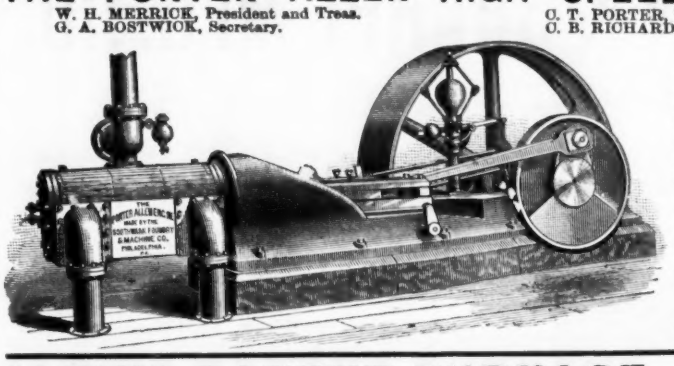
NEW YORK AGENCY OF THE TANITE CO., AND GRANT & BOGERT MACHINE TOOL WORKS.

H. PRENTISS & COMPANY, 42 DEY ST., N. Y.

THE PORTER-ALLEN HIGH SPEED ENGINE.

W. H. MERRICK, President and Treas.
G. A. BOSTWICK, Secretary.

C. T. PORTER, Vice-President.
C. B. RICHARDS, Superintendent.

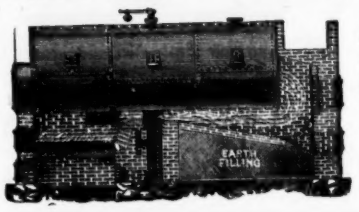


THE SOUTHWARK FOUNDRY & MACHINE CO., Philada., having largely increased its facilities is now prepared to fill all orders for the Porter-Aller Engine on contract time.

Orders solicited for Iron and Brass Castings in the rough.

Address the Company, 430 Washington Avenue, Phila., Pa.

JARVIS PATENT FURNACE FOR SETTING STEAM BOILERS.



Economy of Fuel, with increased capacity of steam power. The same principle as the SIEMANS' PROCESS OF MAKING STEEL, utilizes the waste gases with hot air on top of the fire. Will burn all kinds of Waste Fuel without a blast, including screenings, wet peat, wet hops, sawdust, logwood chips, slack coal, &c. **A. F. UPTON, General Agent,**

Send for circular. 7 Oliver St. (P. O. Box 3401,) Boston, Mass.

BERTON & NICKEL, New York Agents, No. 92 Liberty Street.

POND ENGINEERING CO., Western Agents, 709 Market Street, St. Louis, And 130 W. Second St., Cincinnati, Ohio.

CRAIG'S HYDRAULIC GOVERNOR,

FOR STEAM ENGINES,

The Most Perfect Governor Known.

RUNS IN OIL.

Guaranteed to accurately regulate all classes of engines. Illustrated and descriptive Catalogue sent on application. Correspondence solicited.

W. H. CRAIG & CO., Sole Manufr's, Lawrence, Mass.

—New York Agent—

A. ALLER, 109 Liberty St.

NEW & SECOND-HAND MACHINERY.
July 27, 1882.

1	Engine Lathe,	14 in. swing x 6 ft. bed.	New.
1	" "	11 in. swing x 5 ft. bed.	New.
6	" "	12 in. " x 4 ft. "	New.
6	" "	11 in. " x 3 ft. 6 in. bed.	New.
1	Back Geared Foot Lathe, 9 in. swing x 4 ft. bed, with Slide Rest and 2 Chucks, mounted on wooden bench. Second-hand. Good order.		
2	Leader Foot Lathes.		New.
	Briggs Foot Lathes. Nos. 1 and 2.		New.
	Polishing " Small and Large.		New.
1	Upright Drill, 2 Spindles.		Garvin. "
1	Sensitive Drill.		"
3	Light Drilling Machines.		"

A full assortment of Lathe Attachments, Countershafts, Chucks, Drills, &c., &c.

FRASSE & COMPANY, 62 Chatham Street, N. Y

IRON PLANERS,
DRILLING MACHINES,
ENGINE LATHES,
IRON SHAPERS,
ENGINES & BOILERS

A GENERAL LINE OF

IRON AND WOOD WORKING

MACHINERY.

TOOLS & SUPPLIES

In Store and to Arrive.

O. L. PACKARD,

Milwaukee, Wisconsin.

JEROME B. SECOR,

MANUFACTURER OF

Machinery and Tools,

IMPROVED WIRE FEED SCREW MACHINES, GUN AND SEWING MACHINE TOOLS, DIES FOR DRAWING, FORGING, BLANKING, &c., MADE TO ORDER.

Manufacturer of

THE SECOR SEWING MACHINE,

Factory Cor. Broad & Railroad Ave.

BRIDGEPORT, CONN.

CORLISS ENGINES FOR SALE.

PROMPT DELIVERY.

One 12 inch Cylinder. 36 inch Stroke. At once.
One 14 " 36 " In two weeks.

APPLY TO

THE GEORGE PLACE MACHINERY CO.
121 Chambers & 103 Reade Sts., New York.

Second-Hand & New MACHINERY.

Aug. 1, 1882.

The following New and Improved Machinists Tools are part of what we have for early delivery

1	42 in. Swing,	16 ft. bed.	New Engine Lathe. Aug. 10
1	36 in. "	12 ft. "	" " " 1
1	22 in. swing,	13½ ft.	Bed Engine Lathes.
1	26 in. swing,	14 ft. bed.	Aug. 1st.
1	26 in. "	16 ft. "	" " New.
2	26 in. x 7 ft.	Planers.	New. Aug. 1st.
1	32 in. x 8 ft.	"	" Sept. 1st.
1	38 in. x 10 ft.	"	" Aug.
1	38 in. x 12 ft.	"	" "

The following on hand:

1	26 in. swing,	12 ft.	Bed Engine Lathe.
1	22 in. swing,	11½ ft.	Bed Engine Lathes. New.
2	22 in. "	12 ft.	" "
4	19 in. "	8 ft.	" " "
1	19 in. "	10 ft.	bed. "
2	18 in. "	8 ft.	" "
5	15 in. "	6 ft.	" " "
1	Square Arbor Fox Lathe.		New.
1	15 in. swing,	9 ft.	Hand Lathe. New.
3	12 in. "	6 ft.	" " "
1	10 in. "	4½ ft.	Bed Hand Lathe. New.
2	30 in. x 8 ft.	Planers.	New.
1	26 in. x 26 in. x 6 ft.		Planer. New.
1	22 in. x 4 ft.	Planer.	New.
2	38 in.	Swing Upright Drills.	B. G. & S. F. New.
1	26 in.	Drill.	B.G.&S.F. New.
1	18 in.	Bench Drill.	
1	2 Spindle Drill.		New.
1	4 "	"	"
1	3 "	"	Second-Hand.
2	4 "	"	"
2	Wall Drills, heavy.	Second-hand.	60 in
2	12 in.	Shapers.	New.
2	15 in.	"	"
1	Pratt & Whitney Hand Miller.		
1	Sellers Milling Machine.	2d-hand.	
1	Face Milling Machine.	Second-hand.	
1	Pond's Double Milling Machine.	2d-hand.	
1	No. 2 Screw Machine.	Wire Feed.	New.
1	No. 1 "	Brown & Sharpe.	2d-hand
1	Screw Head Slotter.	Second-hand.	
3	Second-hand Profiling Machines		
2	4½ in Hyde's Patent Centering Machines.		New.
1	Emery Grinder, 2d-hand, for 10 in. Wheels.		
1	Bolt Pointing Machine.	Second-hand.	
1	Double Nut Tapper.	New Horizontal.	
1	Horizontal Boring Machine, 10 in. Swing.	2d-hand.	
1	Betts, No. 2, Power Punch.	New.	
3	Double-Acting Presses, No. 3,	nearly new.	
4	Single-Acting Presses, for power,	"	
100	Foot Presses,	nearly new.	
1	Medium Power Punching Press.	Second hand.	
2	Small "	" Presses.	"
1	Foot Punch, with bench.	New.	
1	Lot Pistol Machinery.	Second-hand.	
4	Grind Stones and Frames.	New.	
1	Steam Hammer.	Cylinder 6½x12.	2d-hand.

Lot of Forges 1 Railway Saw Bench, 1 Foot-power Circular Saw.

Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in store.

The George Place Machinery Company,

121 Chambers and 103 Reade Sts., New York.

HILL, CLARKE & CO.,

36 OLIVER STREET, BOSTON, MASS.,

AND

800 NORTH SECOND STREET, ST. LOUIS,

IRON WORKING MACHINERY.

Outfits for Manufacturing Agricultural Machinery

A SPECIALTY.

Complete List of Tools for Quick Delivery Furnished on Application.

PARTIAL LIST OF LARGE LATHES ON HAND,

40	inch	swing,	12	foot	bed,	Triple Geared Gleason Engine Lathe.
28	"	"	26	"	"	Ames Shafting Lathe.
26	"	"	25	"	"	Powell Shafting Lathe.
26	"	"	20	"	"	" Engine "

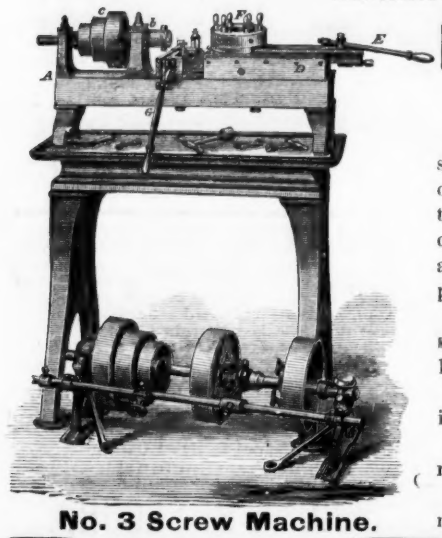
SEND FOR ILLUSTRATED CATALOGUE OF MACHINE TOOLS.

BROWN & SHARPE MFG. CO.

PROVIDENCE, R. I.

MANUFACTURERS OF

Machinery and Tools.



No. 3 Screw Machine.

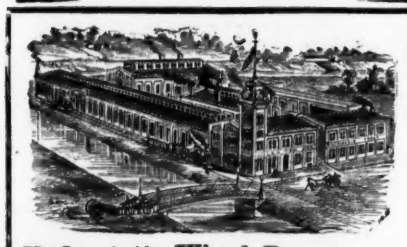
This machine is designed for making such screws as are used by manufacturers of Sewing Machines, and Fire Arms and the smaller kinds of screws used by machinists. It can be used also for tapping and facing small nuts, making washers, pins, etc.

Size of hole through Spindle, 5/8 inch; size of hole in revolving head, 11-16 inch; length that can be milled, 3½ inches.

Friction pulleys on counter-shaft are 10 inches diameter and 3¼ inches wide.

Counter-shaft should run 270 turns per minute.

Weight of machine prepared for shipment about 750 lbs.



MACHINE TOOLS

And Iron-Working Machinery of every description.

BORING AND TURNING MILLS,

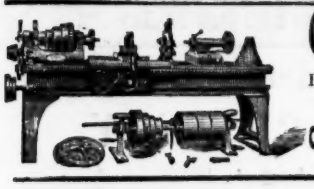
Driving Wheel Lathes.

Hydrostatic Wheel Presses,
Car Axle Lathes,
Car Wheel Borers,
Screw Machines,
Universal Radial Drilling Machines.

Iron Planers,
Engine Lathes,
Upright Drill Presses.
Special Pulley Turning Lathes,
Special Pulley Boring Machines,
&c., &c., &c.

NILES TOOL WORKS, HAMILTON, OHIO.

Eastern Warerooms, 22 S. Sixth St., Philadelphia, Pa.



GRAY'S PATENT 19 IN. LATHE.

Built to Standard Gauges and Templates, with Special Machinery.

EVERY MACHINE BELTED AND TESTED.

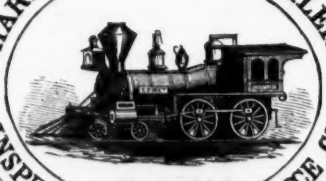
G. A. GRAY, Jr., & CO., 17 EAST 8TH STREET, CINCINNATI, O.

Engine Lathes, Planers, Drills, &c.

DAVID W. POND, Worcester, Mass.

Send for Catalogue of New Designs.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.



J. M. ALLEN, PRESIDENT.

W. B. FRANKLIN, VICE-PRESIDENT.

J. B. PIERCE, SECRETARY.

LODGE, BARKER & CO.

MANUFACTURERS OF

18-inch Swing Screw Cutting Engine Lathes,

189 W. PEARL STREET, CINCINNATI, O.

IMMEDIATE DELIVERY FOR VARIOUS LENGTHS.

—— ANNOUNCEMENT. ——

Having many inquiries for all kinds of Machinists' Tools, we have concluded to sell tools of Eastern make, and have put in a stock of lathes of different lengths and swing from the best Eastern makers. Also cutting-off lathes and centering machines, drills, planers, etc.

EX INUTILI TRADE TANITE MARK UTILITAS

Emery Wheels & Grinding Machines.

THE TANITE CO.

Stroudsburg, Monroe County, Pa.

Orders may be directed to us at any of the following addresses, at each of which we carry a stock:

New York, 42 Dey St.
Chicago, 132 & 134 Lake St.
Chicago, 40 Franklin St.
Minneapolis, 254 Second Ave., South.
Philadelphia, 925 Market St.
Boston, Cor. High & Oliver Sts.
St. Louis, 209 North Third St.
St. Louis, 811 to 819 North Second St.
Cincinnati, Cor. of Pearl & Plum Sts.
Pittsburgh, 137 First Ave.
Indianapolis, Cor. Maryland & Delaware Sts.
New Orleans, Cor. Union and St. Charles Sts.
San Francisco, 2 & 4 California St.
Portland, Oregon, 43 Front St.
Liverpool, Eng., 42 The Temple, Dale St.
Sydney, N. S. W., 17 Pitt St.

The Pratt & Whitney Co.

HARTFORD, CONN., U. S. A.

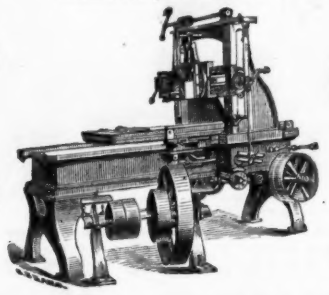
MANUFACTURERS OF

MACHINISTS' TOOLS,

GUN

AND

Sewing Machine Machinery.



MAKE SPECIALTIES OF

SHAPING MACHINES,

PILLAR SHAPERS,

Power Planers

16 x 16 to 48 x 48 inches square, and various lengths. All feeds automatic.

SEND FOR ILLUSTRATED CATALOGUE AND PRICE LIST.

DROP FORGINGS

Of Every Description, from 1-16 ounce to 30 lbs. weight, for

Guns, Pistols, Sewing Machines, Machinists' Tools,

AND MACHINERY GENERALLY.

The Pioneers as a specialty in this line of business. Estimates given promptly on receipt of models Send for Catalogue and Descriptive Circular.

THE BILLINGS & SPENCER CO.

HARTFORD, CONN., U. S. A.

GRANT & BOGERT,

FLUSHING, L. I., N. Y.

MANUFACTURERS OF

14 in. & 26 in.

LATHES.

ROP HAMMERS

Punching Presses

DIES AND OTHER TOOLS

For the manufacture of all kinds of SHEET METAL GOODS, DROP FORGINGS, &c.

Billin & Parker Press Co.

SPECIAL MACHINERY

Built to Order, and

TOOLS OF ALL KINDS,

Shop well furnished for good work.

S. McHENRY, 927 FILBERT STREET, PHILADELPHIA.

E. E. GARVIN & CO.

139 & 141 Centre St., New York.

MANUFACTURERS OF

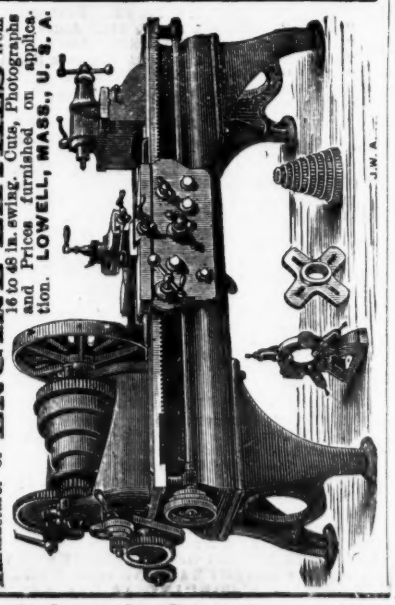
MACHINISTS' TOOLS,

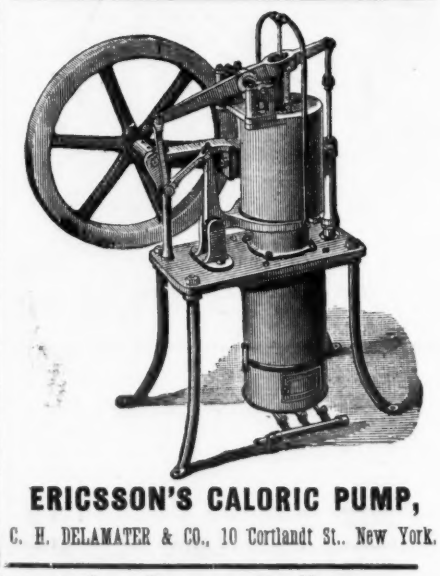
Milling Machines,
Drill Presses,
Hand Lathes,
Tapping Machines,
Cutter Grinders, &c.

SEND FOR NEW ILLUSTRATED CATALOGUE containing descriptions of the above machines.

GEO. W. FIFIELD,

Manufacturer of ENGINE LATHES from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application. LOWELL, MASS., U. S. A.

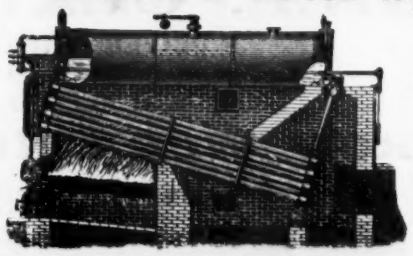




ERICSSON'S CALORIC PUMP,

C. H. DELAMATER & CO., 10 Cortlandt St., New York.

Babcock & Wilcox Water-tube Steam Boilers.



Adapted for all Purposes. Safe from Explosions.

3,678 H. P. in use by SINGER MF'G CO., New York; 3,790 H. P. by HARRISON HAVEMEYER & CO., Philadelphia; 2,880 H. P. by DECASTRO & DONNER SUGAR REFINING CO., Brooklyn; 4,600 H. P. by AMERICAN GRAPE SUGAR CO., Buffalo; 1,350 H. P. by THE JESSUP & MOORE PAPER CO., Wilmington; 720 H. P. by RARITAN WOOLEN MILLS, New Jersey; 600 H. P. by STUDEBAKER BROS. MF'G CO., South Bend, Ind., and hundreds of others in all kinds of business, from 50 H. P. to 2,000 H. P. each.

Centennial Exposition Medal awarded this boiler for highest economy and efficiency on test.

Illustrated Circulars and other desired information promptly furnished.

BABCOCK & WILCOX CO.
30 Courtlandt Street, New York.

THE BUFFALO STEEL FOUNDRY, BUFFALO, N. Y.

PRATT & LETCHWORTH, Proprietors.

Orders and Correspondence Solicited.

J. M. CARPENTER PAWTUCKET, R. I.

MANUFACTURER OF

TAPS & DIES